The Renewable Fuels Standard Must Be Revised

Unless the Renewable Fuel Standard (RFS) is Revised, it Will Limit Gasoline & Diesel Supplies and Adversely Impact Consumers and the U.S. Economy. The RFS was enacted by Congress in 2007 as part of the Energy Independence and Security Act. The RFS contains four "nested" renewable fuel mandates; one each for biomass-based diesel, cellulosic renewable fuel, advanced renewable fuel, and general renewable fuel. The mandates started at a total of 4.7 billion gallons in 2007 and will escalate to 36 billion gallons per year in 2022. In 2013, the renewable fuel mandate is 16.55 billion gallons and in 2014 it is 18.15 billion gallons. For each gallon of gasoline and diesel fuel produced or imported for consumption in the U.S., the refiner or importer incurs an obligation under each of the four renewable fuel mandates.

The amount of gasoline and diesel fuel that refiners and importers can legally produce or import for consumption in the U.S. is limited by their ability to meet the renewable fuel obligations that are incurred by producing or importing such gasoline or diesel fuel for U.S. consumption. Refiners and importers meet their obligations by acquiring renewable fuel credits, referred to as Renewable Identification Numbers (RINs). Unfortunately, as the renewable fuel mandates escalate, RINs are likely to become in short supply. This will in turn adversely impact supplies of gasoline and diesel fuel for U.S. consumers. To remain in compliance with the law, importers will likely have no option but to reduce imports and refiners will likely have no option but to export gasoline and diesel fuel or reduce production.

Why will RINs be in Short Supply and Limit Gasoline & Diesel Supplies? The availability of RINs that refiners and importers need in order to meet renewable fuel obligations is dependent on U.S. consumption of renewable fuels. Unfortunately, consumption of the renewable fuels will not keep pace with the mandates that the law imposes because the mandates go beyond the amount of renewable fuels that are compatible with vehicles and the infrastructure. As a consequence, RINs will be in short supply.

What About E15, E85 and Biomass-Based Diesel? Can't They Solve This Problem? E15 and E85 are not compatible with most retail fueling station infrastructure in the U.S. Both E15 and E85 would typically require large investments ($40,000-200,000 per station) by the owners of the retail stations of which 97 percent are independently owned and operated. With the demand of both E15 and E85 combined by the motoring public being less than 1 % of total U.S. fuel volume, this investment may require pause. Independent retailers have no legal obligations under the RFS to invest in this infrastructure and are not likely to do so without a compelling business reason. Additionally, E15 and E85 are currently compatible with less than 5 percent of cars on the road and, therefore, there will likely be low potential demand for the products. E85 in particular has economic challenges, as it gets approximately 25-30 percent fewer miles per gallon than gasoline. Because of these issues, neither E15 nor E85 are likely to be the source of RINs that will be needed to avoid the adverse impacts of the current RFS program. Nor can biomass-based diesel be counted on to save the RFS. Most vehicles are only compatible with up to 5 percent biodiesel, so there are limits on how much can be used. Biodiesel is also very uneconomic compared to hydrocarbon diesel. The biomass-based diesel requirements under the RFS are already a contributing factor to increasing diesel exports.

What Needs To Be Done to Fix This Problem? The renewable fuel mandates must be lowered to levels that are achievable, i.e. levels where vehicles and infrastructure can realistically absorb the mandated renewable fuels. If this is not done, the existing RFS will limit gasoline and diesel fuel supply in the U.S. and have severe adverse impacts on consumers and the U.S. economy.

AD HOC COALITION
OF
SMALL BUSINESS REFINERS

Comments on
Renewable Fuels Standard Assessment White Paper
Blend Wall and Fuel Compatibility Issues
The Committee on Energy and Commerce

Small Business Refiners (SBRs) are located across the country from Pennsylvania to the West Coast. We vary greatly in operational configuration, product slate, marketing area, crude slate, and capacity. We have worked together for many years in an ad hoc coalition which has enabled us to share views, exchange relevant information and work cooperatively on issues of importance, often of survival. Small Business Refiner flexibilities included in EPA rulemakings and other compliance requirements are particularly important to the continued viability of the small business refiner segment of the industry. We appreciate the opportunity to comment on the Renewable Fuels Standard (RFS) Assessment White Paper and provide valuable information as the Committee on Energy and Commerce deliberates changes to the RFS.

Background on the Ad Hoc Coalition of Small Business Refiners
Small Business Refiners (SBRs) occupy a unique place in the economy and the energy sector. We have long been recognized by the U.S. Congress, Department of Energy, the EPA, the Small Business Administration, Department of Defense and other agencies as critical in providing supply and competition that benefits consumers. Clearly, SBRs have important financial differences from large refiners. It is a well-settled fact that our size limits the options we have to comply economically with new regulations.

<u>Small Business Refiners are important to the economy</u>

- Small refiners foster competition in the petroleum industry.
- Small refiners are critical to easing the tight supply of petroleum products and often are the only source of supply in certain geographic regions.
- Most small refiners serve as the major economic resource in the small, often rural, communities in which they operate.
- It is generally agreed that the economic “multiplier effect” (jobs and other local and regional investment and businesses) resulting from refinery operations is eight-to-ten times the refinery’s actual budget.
- Many small refiners provide a reliable and competitive supply of military jet fuel to our country’s military bases and thus are important to national security.

<u>Small Business Refiners Have Limited Resources</u>

- Access to and cost of capital present much greater obstacles for SBRs.
- Small refiners do not have large staffs to negotiate and implement permitting, regulatory, and compliance requirements.
- The qualified labor pool is limited, especially for SBRs in small communities or remote areas. Attracting qualified employees to rural areas is difficult.

- By contrast, large refiners have more access to a larger qualified labor pool and can maintain large corporate staffs with a diverse range of specialties and in-house expertise.
- Qualified outside engineering consulting is limited even where financial resources to procure such help are available.
- Due to the smaller size of projects, SBRs are disadvantaged when competing with large refiners to garner outside engineering resources.
- The majority of SBRs do not have port access like the majority of large refiners and are therefore more reliant upon local domestic crude supplies and have limited ability to change crude slate when regulations and specifications change.
- The majority of SBRs are less complex and thus have less operational flexibility and fewer outlets for intermediate products.

<u>Small Business Refiners Do Not Enjoy Economies of Scale</u>

- Large refiners are able to spread compliance and operating costs over much greater product sales and over a much greater asset base.
- SBRs are not fully integrated like the large refiners. Many do not have upstream crude oil and gas production, midstream pipelines and terminals, or downstream retail marketing.
- SBRs already have been at a disadvantage with major refiners relative to higher production costs of ultra-low sulfur and reformulated fuels on a per barrel basis.
- SBRs as a group are most vulnerable to decreasing domestic demand for refined products and increased competition from renewable fuels.

Following, you will find input on many of the questions that were posed in the RFS Assessment White Paper released on March 20, 2013. For continuity, the question numbers are consistent with those in the solicitation. Hopefully, the combined input from the SBR ad hoc group will provide valuable insight as the Committee on Energy and Commerce deliberates potential RFS changes.

1. To what extent was the blend wall anticipated in the debate over the Energy Policy Act of 2005 and the Energy Independence and Security Act of 2007?

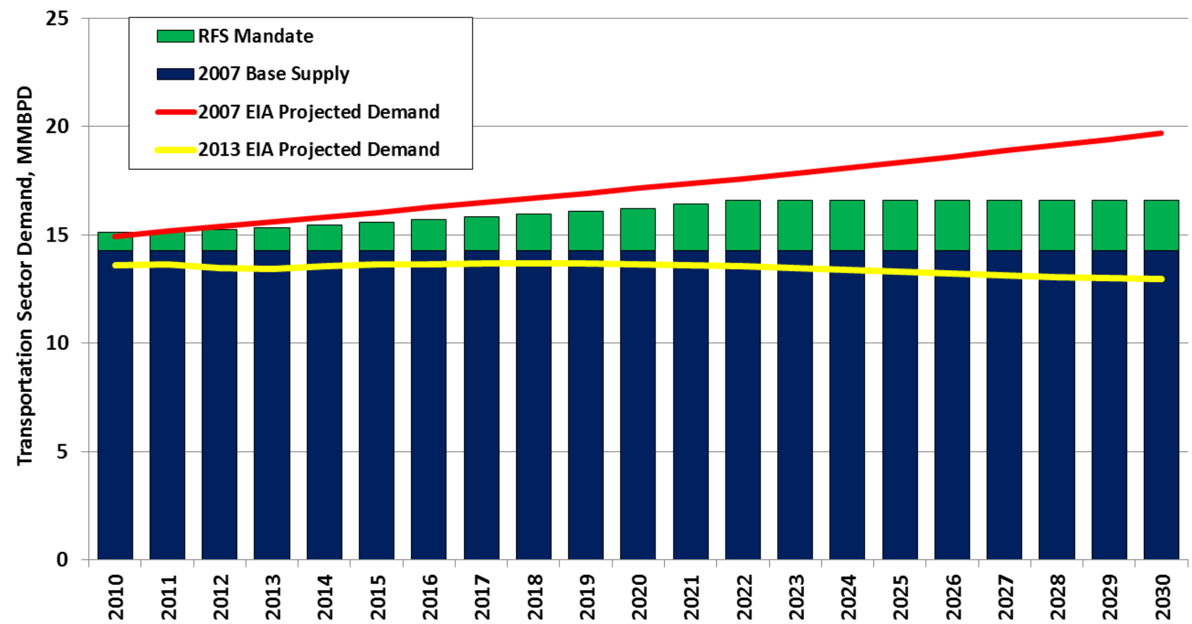
   The SBRs will not speculate on whether or not the blend wall was considered during debate of this legislation. However, the energy landscape and outlook for refined transportation fuels is considerably different now than in 2007.

   Figure 1 provides a comparison of Energy Information Administration (EIA) transportation fuel (gasoline and diesel) demand projections from the 2007[1] and 2013[2] Annual Energy Outlook report combined with 2007 base supply and the RFS mandate. The red line depicts the 2007 transportation fuels demand outlook. The blue column shows the 2007 transportation fuel demand. This "Base Supply" would be supplied primarily by the refining sector since it predates the RFS amendments. Comparing the blue column to the red line shows that there was room for growth to supply the transportation sector. The mandates provided for in the RFS (green column) would have bridged this supply and still left room for growth in all supply sectors in 2013 and beyond if in fact, EIA's demand projections were realized.

[1] Table 11: Petroleum Supply and Disposition Balance; Annual Energy Outlook 2007 with Projections to 2030, U.S. Energy Information Administration.
[2] Table 11: Liquid Fuels Supply and Disposition Balance; Annual Energy Outlook 2013 Early Release, U.S. Energy Information Administration.

As we now know, the 2007 projections have not materialized. The yellow line shows the most recent transportation fuel demand projection from the 2013 EIA Annual Energy Outlook. Total demand is projected to be even lower than the 2007 Base Supply of fuel. Not only has the refining sector had to adapt to lower demand projections for our primary products, the RFS has actually mandated the use of alternatives that further erode the markets for our products. The unintended consequence of flat-to-negative growth is that the government is now picking winners and losers in the supply of transportation fuels.

Figure 1: Comparison of EIA Transportation Fuel Demand Projections



The majority of gasoline supplied in the United States is blended with 10% ethanol. The blend wall is reached when 10% ethanol blended gasoline can no longer absorb the mandated ethanol. Looking at the 2007 EIA projections above, it would appear that the 10% ethanol blend wall would not be reached until 2018 or beyond assuming ALL renewable fuels were ethanol that could be blended into ALL transportation fuels. However, there is a major problem with this assumption, even though blending obligations are determined based on the total volume of manufactured petroleum based transportation fuels, both gasoline and diesel, ethanol cannot be blended with diesel fuel. Based on EIA's 2007 projection for gasoline demand ONLY, the ethanol blend wall should have been projected to be met in the 2012-2013 timeframe.

Gasoline and diesel fuel are not treated separately in the RFS nor are the renewable fuels (primarily ethanol and biodiesel) that can practically be blended into each. A major flaw with the RFS is that it assumes that all flavors of fuel - gasoline, biodiesel, ethanol, diesel fuel – are interchangeable when in reality they are not.

2. What are the benefits and risks of expanded use of E-15 to automakers, other gasoline powered equipment makers, refiners, fuel retailers, and others involved in the manufacture and sale of gasoline and gasoline-using equipment?

We can only speak to the benefits and risks that an expanded use of E-15 would create for small business refiners. At this time, our SBR group has not identified any benefits; however, the risks are outlined below.

a) As outlined in the previous section, demand for transportation fuels is declining. This combined with the increasing RFS mandate puts SBRs in the most vulnerable position in our industry. Refining is a manufacturing business that participates in between two related but independent commodity markets. Margins are driven by supply and demand dynamics on the feed side (crude and intermediates) and the product side (gasoline and diesel). Because of our size, SBRs do not enjoy the economies of scale that our larger competitors have.

   As an example, many large refiners are currently investing in the purchase of rail cars to take advantage of the shale oil revolution that is currently taking place in North America. This combined with ownership in major crude and product pipelines makes larger refiners integrated and allows them to continue operating in a low refining margin environment. Large refiners have also integrated into renewable fuels having ownership in both ethanol and biodiesel production.

   Since SBRs do not have the capital to invest in this integration, SBRs' survival is most at risk. In addition, since many small refiners are located in areas where renewable fuels are not being produced, the RFS mandate puts those at a distinct disadvantage. Moving to an E-15 blend not only takes away 5% of our market but also requires obligated parties to provide that market share to renewable fuels competitors by requiring us to spend the capital on infrastructure (without return on investment) to market and sell their product. This clearly "picks the pockets" of the small refiner to financially support a competitor's business while they assume none of the marketing risk.

   SBRs own forty-one (41) of the approximate 138 operating U.S. refineries. The average capacity of this group is about 30,000 barrels per day. Based on the 2013 EIA Annual Energy Outlook, 5% of the transportation market is equal to over 680,000 barrels per day of fuel when demand is projected to peak in 2017-19. In essence, going to E-15 would eliminate the need of over 22 average small refineries.

   Many small refineries are located in rural areas and provide good jobs and support local communities. Eliminating nearly half of those refineries would result in significant economic harm to those areas. When EISA was passed, Congress recognized the probable impact on small refineries and provided a two-year waiver, believing growth in the market would help alleviate the problem. This has clearly not happened and small refineries are now squeezed more than ever between declining demand and the increasing biofuel mandate.

b) Congress and the U.S. Environmental Protection Agency have historically and consistently recognized that small refiners and small volume refineries experience the greatest difficultly and hardship complying with major regulation, such as the RFS. When Congress passed the Energy Policy Act of 2005 (enabling the RFS), small refineries were provided an initial five-year exemption from any RFS requirements. Further, in 2011, the EPA granted an additional two-year RFS exemption to approximately 13 small refiners due to economic hardship provisions. Clearly, this is a size and class of refineries that struggles with the high cost of RFS compliance, now more than ever with declining demand and increased mandates.

   From an economy-of-scale perspective, small refineries face higher per barrel operating costs than the industry at large because there are fewer barrels to spread fixed and variable costs.

This situation is made worse by the current RFS which requires small refineries to essentially reduce gasoline production to make room for required ethanol blending. Reducing operating rates to accommodate ethanol further degrades the already challenged economy-of-scale inefficiencies small volume refineries face. A requirement to blend *even more* ethanol (E-15) exacerbates this constrained operating situation. This directly threatens the long-term viability of small refineries.

c) Another risk associated with increased ethanol blending to E-15 is disposition of the butane normally blended into gasoline. Many large refineries are located in areas with multiple industries or natural gas liquid (NGL) storage facilities which provide many outlets for light materials such as butane. Conversely, for SBRs located in rural areas with limited access, managing butane produced by the refining process by blending into gasoline is critical especially in the summer months when lower vapor pressure gasoline is required. For conventional gasoline, the Clean Air Act provides a 1 psi waiver on Reid Vapor Pressure (RVP) for 10% ethanol blends. The 1 psi waiver allows the obligated party to blend ethanol and butane while maintaining compliance. This avoids the economic penalty of selling butane via rail or truck at a severely discounted price.

   E-15 blends do not have the 1 psi RVP waiver. According to the EPA, the 1 psi RVP cannot be granted if E-15 is to be considered substantially similar to conventional gasoline. Therefore, to blend E-15, the producer must reduce the RVP of the base fuel by 1 psi by removing butane which results in a significant economic impact. As an example, one SBR has estimated the economic penalty to be nearly $6 million per year due to the lost opportunity to blend butane into gasoline.

d) The introduction of E-15 into the marketplace presents liability concerns for SBRs. Many automakers will not honor warranties if E-15 is used. When E-15 causes damage to personal property, individuals will go to the fuel source for compensation. Our position on liability associated with our compliance with Federal Rules requiring us to produce blended fuels is simple – entities that produce, distribute and dispense various fuels required by law should be immune from any form of liability where government regulations have been followed by the producer, distributor or dispenser. Despite EPA testing on this issue, our concerns that mixing gasoline and ethanol in various ratios could give rise to damage claims based upon the presence of those fuels if Congressional action to prohibit such actions does not occur, is legitimate and real. Our remedy to this would be to propose legislation substantially similar to HR 4345 introduced in the 112^{th} Congress.

4. What is the likely impact, if any, of the blend wall on retail gasoline prices?

   There are many examples provided in this letter that point to an increase in retail gasoline prices due to the blend wall. In this section, the negative effects that fuel exports and RIN pricing have on the cost of compliance to the RFS are illustrated.

   The approaching blend wall is creating a chain reaction that will disproportionately affect, most likely severely, SBRs with limited or no ability to export product. The harm to these small refiners will increase annually as exporting refiners shed their compliance burden and as that burden lands on refiners who do not export including many, if not all, SBRs. This harm is a direct result of RFS. The damage is a built-in component of the program.

   As the RFS volume mandates increase annually, refiners' renewable fuel compliance obligations are approaching or exceeding the ethanol volume that can be blended at a 10% blend rate into the finished gasoline volumes purchased by consumers. Although EPA has approved ethanol blends of 15% and 85%, the use of these fuels is limited to specific newer model year or flex-fuel vehicles. In addition, vehicle manufacturers have provided ample warnings about their warranties not covering the use of these higher blend fuels in older non-flex fuel vehicles. Finally, SBRs' experience is that consumers are simply not interested in buying higher ethanol gasoline which is highlighted in the answer to question 6. Higher ethanol blends are not meeting their promise of preventing the blend wall. Simply put, the ethanol volume refiners are legally obligated to blend will not fit into the pool of gasoline Americans are consuming.

There appears to be two options for minimizing the effects of this dilemma. Unfortunately, both options are most useful to larger companies and neither is a good choice for SBRs. One option is to purchase Renewable Identification Numbers (RINs) to demonstrate compliance. The price of RINs, however, has skyrocketed as the actual volume of blended ethanol is reaching the point of market saturation. RINs have very limited liquidity, and trading is restricted, if not impossible, until the ethanol for which they are a proxy has been physically blended into gasoline. If no more ethanol can be blended into the nation's gasoline pool, no more RINs are available for purchase. The resulting price increases make compliance-through-RIN-purchase a much more difficult option for small refiners than for larger, better capitalized companies. In the end, the higher cost of compliance through the purchase of RINs will be paid by the retail consumer through higher priced fuel.

The second option is to export products. This works because exports are exempted from the RFS and because of the method for setting the compliance obligation for each individual refiner. Annually, EPA establishes a renewable fuel standard for the coming year by dividing the fuel volume to be domestically consumed as projected by EPA and the EIA into the upcoming statutory renewable fuel volume. The result is a fraction or percent that each refiner must apply to its fuel production that is sold domestically. Since, by law, exports are exempted from RFS compliance, a refiner can reduce the volume of ethanol it must blend by exporting refined products and, thereby, reducing its domestic sales to which the renewable fuel standard percentage must be applied. Exporting will reduce rising RIN prices' negative impact on a refiner's bottom line. Unfortunately, few if any small refiners can export refined products due to economic access to those markets.

As exports increase, prices are likely to follow in response to reduced supplies thereby providing a dampening effect on consumer demand. Reduced or slow growing consumption has no effect on the statutory renewable fuel volumes. Those volumes are written into law. The result is that the renewable fuel standard percentage will have to grow faster each year in order to force larger and larger volumes of ethanol into a gasoline consumption pool that is not keeping up. A higher percentage, however, will force refiners to seek more RINs since higher ethanol blend gasoline is finding little or no place in today's market. The price of RINs will go up in tandem with demand, and the situation will go full circle when refiners, who are able, export even more refined products to increase their RFS exemption. This will repeat and amplify each year as the statutory volumes go up while increasing exports put more upward pressure on domestic consumer prices and downward pressure on domestic demand. The overwhelming burden of this compliance spiral will shift to refiners who are unable to export their product, and the burden will fall disproportionately in increasingly greater amounts on SBRs.

While it is true refiners that do not meet their annual RFS compliance obligation in any year can carry their deficit forward to the next year, this provision of the program provides only temporary relief in the current year and makes the problem worse in the following year because the renewable fuel standard percentage increases resulting in RIN demand and prices increasing. At the same time, the obligated party must eliminate not only the deficit from the previous year but also 100% of the new requirement.

5. What is the timing of the implementation challenges related to the blend wall? Will some entities face difficulties earlier than others?

   Recent articles have outlined the impact of the approaching blend wall and the impacts on RIN prices. Higher blends of ethanol will be slow to market while gasoline demand is decreasing; therefore, the blend wall is imminent. Some obligated parties cannot blend ethanol or biodiesel so they must purchase RINs for compliance. As discussed previously, some SBRs are not integrated with pipeline and terminal operations. In addition, they are located in small rural markets where they serve the local market. If that local market does not absorb all produced product, it must be transported to markets on common carrier pipelines. Since ethanol cannot be transported via pipeline, SBRs lose the ability to blend ethanol. Many times, this product is sold to independent marketers who have pipeline and terminal capacity and renewable fuel blending capability.

   These independent marketers are often NOT obligated under the RFS; however, they have the capacity to blend ethanol and separate the RIN from the renewable fuel. In turn, since they are not obligated under the RFS, they can sell those RINs back to the obligated refiner. This system "worked" when ethanol blending was below the blend wall and RIN prices were less than a cent per gallon. With ethanol RINs being greater than 50 cents per gallon, non-obligated marketers have several distinct advantages over the obligated party – especially the SBR. First, since the marketer is non-obligated, they can secure market share at the expense of the small refiner because they do not bear the cost of compliance. Second, the marketer can separate the RIN and sell them to an obligated party – often times to the same obligated party that sold them the fuel. The non-obligated party can wait to sell and speculate in the market which drives the price of RINs and compliance up. Eventually, the cost of the base fuel produced by the obligated party will need to increase to offset the higher cost of compliance or that producer goes out of business. In the long run, this results in higher fuel costs to the consumer and/or a weakening of American manufacturing – both of which are unintended consequences of the RFS.

6. Could the blend wall be delayed or prevented with increased use of E-85 in flexible fuel vehicles? What are the impediments to increase E-85 use? Are there policies that can overcome these impediments?

   Statistically, the blend wall could be avoided by increased use of E-85. There are approximately 10 million flex fuel vehicles on the road today.[3] According to a recent OPIS report, the average E-85 use per flex fuel vehicle in the U.S. last year was about 12.5 gallons. The total E-85 use was about 125 million gallons.[4] The average U.S. vehicle uses about 530 gallons per year to travel the 11,500 miles of average annual vehicle use.[5] If all the flex fueled vehicles only used E-85 (factored for fuel efficiency loss) the U.S. could consume about 6.6 billion gallons of E-85 or a little over 5.6 billion gallons of ethanol per year. This would certainly be sufficient to delay or prevent the blend wall. However, there are certainly reasons why there is such a disparity between potential and actual use of E-85.

[3]Jim Motavalli (2012-03-01). "Flex-Fuel Amendment Makes for Strange Bedfellows". *The New York Times*.
[4]Beth Heinsohn (2013-3-25) "Market Overview: Consumer Economics". *Oil Price Information Service Newsletter.*
[5]U.S. EPA Clean Energy, www.epa.gov/cleanenergy/energy-resources/refs.html, March 28, 2013.

Retail gasoline locations are in the business to make money and will do what they can to provide the customer the products they desire in order to attract their business. Of the approximate 150,000 retail gasoline sites in the U.S.,[6] a little less than 2% of them offer E-85 to their customers.[7] This demonstrates the lack of demand for retailers to carry this product. An illustration of this comes from a local retailer in one SBRs area who offered E-85.

The retailer opened his site with E-85 availability. He did everything correctly to assure the quality of the product was maintained. This included a new separate tank for E-85 storage and a separate pump (with appropriate labeling) for the product. He priced the product aggressively even to the point where he was making less margin on the E-85 fuel than he was on his other gasoline products. He advertised to the community (a higher income area where the expectation of more flex fueled vehicles would exist) touting the availability of E-85 and had high hopes of the success of this product.

However, the largest percentage of his sales that E-85 ever reached was 5%. The retail gasoline merchant normally does not make a large portion of his retail profit on the sale of petroleum products. He instead counts on those products to generate traffic that will lead to inside sales where the profit margin is much higher. E-85 was offered for over 2 years with little improvement in demand for the product. The retailer made the decision to convert the tank and pump to provide a gasoline product that does not contain any ethanol. This product currently makes up about 30% of his total gasoline sales and has been a driver in the success of that location. He prices this product well above the ethanol blended products available at his location and has seen continued improvement in overall traffic.

Experience from a different SBR reiterates that there is little consumer acceptance of E-85. As a farmer-owned cooperative, E-85 sales are consistent with the marketing message of the local cooperative that serves as the fuel retailer. Eighteen of the 101 (18%) branded retail stations offer E-85 to their customers. If consumer acceptance of E-85 were equivalent to conventional gasoline, one would assume that nearly 18% of total retail gasoline sales would be E-85. However, based on proprietary sales data, over the last 5 years E-85 sales have averaged about 1.4% of total branded gasoline sales. This is comparable to the experience of the single retailer described above.

Consumers will not purchase a fuel that has 25% less energy content which results in 25% less gas mileage and range on a single fill up. In addition, current retail pricing does not reflect the lower energy content of E-85. For it to be cost effective for the consumer, it would need to receive a 25% discount at the retail pump. However, to do this, the retail operator would lose money on every gallon of E-85 that is sold. For example, current wholesale market Reformulated Blendstock for Oxygenate Blending (RBOB) price is $3.11 per gallon and ethanol price is $2.36 per gallon. A 25% discount would put E-85 at $2.33 per gallon at equivalent energy content. To make the E-85 blend requires 15% RBOB and 85% ethanol at a cost of $2.47 per gallon. Therefore, if a retailer sold E-85 at its energy equivalent it would lose 14 cents per gallon on every gallon of E-85 sold. This illustrates the real economic problem with E-85.

[6] 2013 NACS Retail Fuel Report, "*Key Facts and Figures*", www.nacsonline.com/NACS/Resources/campaigns/GasPrices_2013/Pages/StatisticsDefinitions.aspx, March 27, 2013.

[7] U.S. Department of Energy Alternative Data Center, www.afdc.energy.gov/laws/law/US/10513, March 27, 2013.

There are programs already in place that help the retail operator in making the conversion to allow for E-85 sales (the Federal Alternative Infrastructure Tax Credit)[8], but unless the public is demanding the product, there is no incentive to change the site to provide a product that few customers would use. Again, the retailer is in the business of increasing store traffic and if a product does not provide the incentive for additional sales, there is no incentive to change. If the product provided the necessary demand more than 2% of the retail sites that would offer the product. Nothing is stopping ethanol companies from buying street corners and opening their own retail stations that provide E-85. Instead of taking the economic risk, their preference is to mandate the refining industry market their product through expanded E-85 (and E-15) sales. The public wants what the public wants and right now they do not appear to want E-85.

As mentioned above, without demand from the general public to make E-85 available to them on a more widespread basis, there are few policies that can change public demand. The only current policy that could make a significant change in demand would be forcing retail locations to provide E-85 or force consumers to use the product in their flex fueled vehicles. Both of these options would be met with tremendous consumer and business opposition and most likely lengthy legal action. The true impediment in the increased use of E-85 is a lack of consumer acceptance and demand.

8. Can blend wall implementation challenges be avoided without changes to the RFS? Is the existing EPA waiver process sufficient to address any concerns? If the RFS must be changed to avoid the blend wall, what should these changes entail? Should any changes include liability relief or additional consumer protections for addressing misfueling concerns?

   This SBR ad hoc group does not believe that the blend wall can be avoided without changes to the RFS. Transportation fuel demand has decreased dramatically since the RFS was contemplated. Plus there are structural changes to the oil and natural gas production and refining industry that have changed the domestic energy outlook. Our industry is now a net exporter of finished diesel fuel and will soon be a net exporter of gasoline. Regardless of the crude source, our industry is a beaming example of how U.S. manufacturing can compete and win in a global marketplace.

   History has shown that the EPA is unwilling to waive the RFS requirements either in total or partially. The severe drought in 2012 resulted in historically high corn prices which has reduced ethanol production and availability. The ethanol industry is projected to under produce the mandated volume for the first time in 2013. Even if the EPA granted the waiver, it would have been limited to one or two years. Granting waivers on an annual basis would be problematic because it would drive uncertainty for those obligated for compliance like SBRs. Even with high production, the blending of ethanol into gasoline has hit the wall at 10%. Consumers are unwilling to purchase increased ethanol blends. At the same time, with domestic demand for transportation fuel either flat or declining, something must change. It is understandable that when a market is growing there is room for participants to prosper. But when the market is shrinking, mandates have the unintended consequences of picking winners and losers. We respectfully ask Congress to recognize these realities and scale back, or eliminate, the RFS.

[8] U.S. Department of Energy, www.afdc.energy.gov/laws/laws/US/tech/3270, March 28, 2013

Thank you for your consideration of these comments. As Congress moves to address the Renewable Fuels Standard and the significant challenges that it presents in the current transportation fuels market, we believe the SBR ad hoc group will be an enthusiastic and valuable participant in your deliberations.

For further information or any questions, please contact any of the below listed companies or Matt Smorch, Vice President – Strategy, Countrymark Cooperative Holding Corporation, 225. S. East Street Suite 144, Indianapolis, IN 46022 (office: 317-238-8228; email: matt.smorch@CountryMark.com).

The following companies endorse the preceding comments:

American Refining Group, Bradford, PA
Calumet Specialty Products Partners, LP

- Shreveport, LA
- Cotton Valley, LA
- Princeton, LA
- San Antonio, TX
- Superior, WI
- Calumet Montana Refining, Great Falls, MT

Countrymark Cooperative Holding Corporation, Indianapolis, IN

- Mt Vernon, IN

Delek US Holdings, Brentwood, TN

- Tyler, TX

Ergon Incorporated, Jackson, MS

- Ergon West Virginia, Newell, WV
- Ergon Refining, Inc., Vicksburg, MS

Petro Star, Inc., Anchorage, AK
Placid Refining Company, LLC Dallas, TX

- Port Allen, LA

Sinclair Oil Corporation, Salt Lake City, UT

- Sinclair, WY
- Evansville, WY

United Refining Company, Warren, PA
U.S. Oil & Refining Co., Tacoma, WA
Western Refining, Tempe, AZ

- El Paso, TX
- Gallup, NM

Wyoming Refining Company, Denver, CO

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Steptoe
STEPTOE & JOHNSON LLP

April 5, 2013

TO: House Energy and Commerce Committee

FROM: Society of Independent Gasoline Marketers of America

RE: Renewable Fuel Standard Assessment White Paper

The Society of Independent Gasoline Marketers of America ("SIGMA") applauds the Energy and Commerce Committee for conducting this review of the renewable fuel standard ("RFS"). SIGMA represents a diverse membership of 260 independent chain retailers and marketers of motor fuel. SIGMA members know first-hand the legal and logistical complexities associated with the RFS, and are pleased to provide the following answers to the Committee's questions set forth in its March 20, 2013 White Paper addressing the blend wall and fuel compatibility issues.

1) *To what extent was the blend wall anticipated in the debate over the Energy Policy Act of 2005 ["EPAct05"] and the Energy Independence and Security Act of 2007 ["EISA"]?*

The blend wall was not anticipated during the debate leading up to EPAct05 or EISA, as both statutes were enacted during robust periods of economic growth, when it was assumed that demand for gasoline would continue to grow. Among other factors, the decline in demand for gasline has precipitated the approaching blend wall. Of course, the volume obligations laid out in EPAct05 were too low to trigger any blend wall concerns. The higher volume obligations established in EISA did not go through regular order in the House, but were established behind closed doors without informed industry input. This also helps explain why the blend wall was not anticipated in the debate over EISA.

2) *What are the benefits and risks of expanded use of E-15 to automakers, other gasoline powered equipment makers, refiners, fuel retailers, and others involved in the manufacture and sale of gasoline and gasoline-using equipment?*

Risks

Fuel retailers face three distinct risks associated with expanded use of E-15, all of which are addressed in H.R. 1214, the Domestic Fuels Protection Act of 2013.

i. Misfueling

Under the partial waivers that EPA granted in connection with E-15 in 2011, only vehicles manufactured in model year 2001 or later are authorized to fuel with E15. Older vehicles, motorcycles, boats, and small engines are not authorized to use E15. Provided retailers abide by all of the signage and other requirements associated with selling E-15, they should not be held responsible for failing to prevent a customer from misfueling. Until EPA clarifies that it will not do so, retailers will be reluctant to sell E-15. EPA can administratively resolve this issue without resorting to formal notice-and-comment rulemaking.

For the retailer, bifurcating the market in this way presents a serious challenge. Typically, when new fuels are authorized, older vehicles can use the new fuel. Today, E-15 might not be compatible with the legacy fleet, and it is currently unlawful to refuel the legacy fleet with E-15.

H.R. 1214 addresses this challenge directly by requiring EPA to issue misfueling regulations whenever the agency approves a fuel for only a subset of engines. EPA has already taken such steps with regard to E15 and has issued regulations requiring E15 retailers to affix a specific label to their dispensers to inform consumers of the authorized and prohibited uses of the fuel. The bill further provides that retailers cannot be held responsible for violating the Clean Air Act in the event a self-service customer introduces a registered fuel (such as E15) into an engine for which that fuel has not been approved (provided the retailer complies with the Agency's misfueling regulations).

ii. Liability Exposure

a. Infrastructure Compatibility

By law, all equipment used to store and dispense flammable and combustible liquids must be certified by a nationally recognized testing laboratory. These requirements are found in regulations of the Occupational Safety and Health Administration.[1] Currently, there is essentially only one organization that certifies such equipment – Underwriters Laboratories ("UL"). UL establishes specifications for safety and compatibility and runs tests on equipment submitted by manufacturers for UL listing. Once satisfied, UL lists the equipment as meeting a certain standard for a certain fuel.

[1] 29 C.F.R. 1926.152(a)(1) ("Only approved containers and portable tanks shall be used for handling of flammable and combustible liquids." "Approved" is defined at 29 C.F.R. 1910.106(35) ("Approved unless otherwise indicated, approved, or listed by a nationally recognized testing laboratory."))

Prior to 2010, UL had not listed a single motor fuel dispenser (*i.e.*, gas pump) as compatible with any fuel containing more than 10% ethanol. This means any dispenser in the market prior to 2010 is not legally permitted to sell E-15, E-85, or anything else above 10% ethanol – even if it is able to do so safely.

If a retailer fails to use listed equipment, that retailer is violating OSHA regulations and may be violating tank insurance policies, state tank fund program requirements, bank loan covenants, and potentially other local regulations. In addition, the retailer could be found negligent *per se* based solely on the fact that his fuel dispensing system is not listed by UL.

Thus, in order to comply with the law, retailers wishing to sell E-10+ fuels can only use equipment specifically listed by UL as compatible with such fuels. Because UL did not list any equipment as compatible with E-10+ fuels until 2010, only those units produced *after* that date can legally sell E-10+ fuels. All previously manufactured devices, even if they are the exact same model using the exact same materials, are subject only to the UL listing available at the time of manufacture. (UL policy prevents retroactive certification of equipment.)

Practically speaking, this means that a vast majority of retailers wishing to sell E-10+ fuels must replace their dispensers. This costs an average of $20,000 *per dispenser*. It is less clear how many underground storage tanks and associated pipes and lines would require replacement. Many of these units are *manufactured* to be compatible with high concentrations of ethanol, but they may not be *listed* as such. Further, if there are concerns with gaskets and seals in dispensers, care must be given to ensure the underground gaskets and seals do not pose a threat to the environment. Once a retailer begins to replace underground equipment, the cost can escalate rapidly and can easily exceed $100,000 per location.

In 2011, EPA issued guidelines for determining the compatibility of underground storage tank equipment with new fuels. Those guidelines, which are now being incorporated into legally binding regulations, stipulate that compatibility can be demonstrated either with a listing from a nationally recognized testing laboratory, written documentation by the equipment manufacturer, or another standard to be adopted by the states. SIGMA generally supports these regulations, but they offer retailers very limited certainty.

First, the regulations apply only to underground storage tank systems and do not cover the fuel dispenser itself.

Second, retailers still must use equipment that complies with regulations enforced by other jurisdictions. It is unclear whether the regulations will satisfy OSHA regulations, tank insurance, bank covenants, or other requirements. If retailers behave in a manner consistent with EPA's standards of care, they should be deemed to have met all similar relevant standards of care.

H.R. 1214 seeks to fix these problems. The legislation directs the EPA to revise the regulations to establish a minimum standard of care for manufacturer self-certification to ensure there is no backsliding in protecting the environment; it establishes that the compatibility regulations will apply to the fuel dispenser; and it provides the equipment owner with regulatory and legal certainty by stipulating that equipment which satisfies the EPA compatibility requirements will be considered to satisfy all compatibility-related requirements that may be applied to the retailer.

H.R. 1214 does not in any way relieve a tank owner from responsibilities regarding a fuel release. The retailer will remain responsible for preventing a fuel release and for cleaning up any contamination that may occur as a result of a release. However, the retailer will not be *per se* negligent provided his equipment satisfies the requirements established by EPA. SIGMA members take very seriously their responsibility to protect the environment and prevent releases from their systems. Their support for this legislation is based upon the realization that some of their equipment is perfectly compatible and can safely store and dispense new fuels such as E-15, yet the law precludes them from doing so. If their equipment is safe and compatible, they see no reason why they should be required to incur significant expense to replace it.

b. Warranty Violations

H.R. 1214 also addresses another potential liability that is associated with an engine warranty. The EPA decision to approve E-15 for 2001 and newer vehicles is not consistent with the terms of most warranty policies issued with these affected vehicles. Consequently, while using E15 in a 2009 vehicle might be lawful under the Clean Air Act, it may in fact void the warranty of the consumer's vehicle. Retailers have no mechanism for ensuring that consumers abide by their vehicle warranties – it is the consumer's responsibility to comply with the terms of their contract with their vehicle manufacturer. Therefore, H.R. 1214 provides that retailers shall not be held liable in the event a self-service customer introduces a fuel into their vehicle that is not covered by their vehicle warranty. Of course, retailers that fail to comply with EPA's misfueling regulations (or are otherwise negligent) could still be held liable under the bill.

iii. Defective Product

There are widespread concerns throughout the retail community and with their product suppliers that the rules of the game may change and they could be left exposed to significant liability. For example, E-15 is approved only for certain engines and its use in other engines is prohibited by the EPA due to associated emissions and performance issues.

What if E-15 does indeed cause problems in non-approved engines or even in approved engines? What if in the future the product is determined defective, the rules are changed and E-15 is no longer approved for use in commerce? There is significant concern that such changes in the law would be retroactively applied to anyone who manufactured, distributed, blended or sold the product in question.

Retailers are understandably hesitant to enter new fuel markets without some assurance that their compliance with the law today will protect them from retroactive liability should the law change in the future. It seems reasonable that law abiding citizens should not be held accountable if the law changes in the future. That is what H.R. 1214 does – it helps overcome significant resistance to new fuels by stipulating that entities that manufacture and market fuels which are authorized and registered by the Federal government, in accordance with Federal regulations, cannot be held retroactively liable for damages caused by such fuels that the Federal government previously determined to be safe for the public and the environment. This provides assurances that market participants will only be held to account for the laws as they exist at the time and not subject to liability for violating a future law or regulation. If the rules change, retailers will adjust and comply, but they cannot be expected to comply with laws that do not yet exist.

Benefits

Retailers stand to benefit by expanded use of E-15 in the marketplace – provided such use does not force them to incur unreasonable additional liabilities. Diverse sources of supply promote competition for marketers' business. More options and greater competition drive down prices, reducing marketers' costs of goods sold.

3. *What are the risks of the introduction and sale of E-15 to the owners of pre-2001 motor vehicles, boats, motorcycles, and other gasoline-powered equipment not approved to use it? Are there risks to owners of post-2001 vehicles? How do these risks compare to the benefits of the RFS?*

The risks are unknown; EPA has said that without understanding the actual risk, it is unlawful to introduce E-15 into this equipment. The risk therefore lies in the fact that there is not a sufficient empirical basis to conclude that use of E10+ fuels in these machines is safe.

4. *What is the likely impact, if any, of the blend wall on retail gasoline prices?*

As the blend wall approaches (some would argue it has already arrived in some forms), there will be insufficient demand for blends greater than E-10 to absorb the amount of ethanol being produced. This will result in an insufficient number of renewable identification numbers ("RINs") to meet obligated parties' renewable volume obligations. Less RINs leads to financial exposure for producers and importers, which will be passed down to the consumer in the form of higher retail gasoline prices.

5. *What is the timing of the implementation challenges related to the blend wall? Will some entities face difficulties earlier than others?*

The timing of the implementation challenges related to the blend wall is immediate. Already the price of a RIN has risen to a high of more than $1.00 in early 2013 when the price was as recently as two years ago less than $0.10. This is because obligated parties recognize the difficulty they will have in procuring RINs once we hit the blend wall so their value naturally increases. This in turn increases their costs in manufacturing and/or importing product, and ultimately results in higher prices at the pump.

Once we do hit the blend wall, ethanol producers are likely to have difficulty selling product because there will be no additional gasoline with which to blend it. If the solution to the blend wall ends up being enhanced use of E-15 and/or E-85 in commerce, many retailers will of course be forced to replace their current equipment or be vulnerabile to liability issues (*see* Q.2 above).

6. *Could the blend wall be delayed or prevented with increased use of E-85 in flexible fuel vehicles? What are the impediments to increased E-85 use? Are there policies that can overcome these impediments?*

Increased use of E-85 in flexible fuel vehicles would naturally delay or – if the increase is large enough – prevent the market from reaching the blend wall, but of course there are a number of impediments to increased E-85 use. First and foremost is a lack of consumer demand. There are very few flex-fuel vehicles on the road today, and many of those that are on the road do not use E-85 because of (a) a lack of availability (itself due to a lack of demand), and (b) the lesser fuel efficiency of E-85 relative to E-10. Without consumer demand for E-85, there is little incentive for retailers to invest in additional infrastructure required to store and dispense E-85. Many SIGMA members have in fact invested in E-85 infrastructure, though it has generally been under-utilized on account of insufficient consumer demand.

7. *Is E-15 misfueling unavoidable? Are there lessons from the labeling and dispensing of diesel, E-85 and other fuels that prevent their misfueling that can also be applied to E-15? What specific actions are companies taking to address potential misfueling concerns under [Misfueling Mitigation Plans]?*

Misfueling is not unavoidable, but history shows that it is probably inevitable at some limited level. (Witness the recent past: on President Obama's recent trip to Israel, the Secret Service filled the President's diesel limousine with gasoline.) Recognizing this fact should lead one to support H.R. 1214. Lessons to be drawn from E-85 and other fuels are that education and signage are the best ways to prevent misfueling, both of which are central components of EPA's misfueling regulation. Retailers cannot rely on sales associates in the store to prevent misfueling, as outlets may now have upwards of 20 or 25 pumps.

8. *Can blend wall implementation challenges be avoided without changes to the RFS? Is the existing EPA waiver process sufficient to address any concerns? If the RFS must be changed to avoid the blend wall, what should these changes entail? Should any changes include liability relief or additional consumer protections for addressing misfueling?*

A number of implementation challenges can in fact be avoided or mitigated without changing the RFS. First, those provisions of H.R. 1214 pertaining to new fuels' compatibility with existing equipment (*see* Q.2-ii-a above) do not make any changes to the RFS yet would help facilitate introduction of higher ethanol blends into commerce.

Second, EPA can clarify its misfueling rule to specifically state that retailers who comply with all signage and other relevant requirements for selling E-15 will not be held liable in instances of consumer misfueling. These measures will minimize retailers' liability concerns and thereby facilitate the introduction of E-15 and other new fuels into commerce without changing the RFS.

Third, Congress can provide that entities that manufacture and market fuels which are authorized and registered by the Federal government, in accordance with Federal regulations, cannot be held retroactively liable for damages caused by such fuels that the Federal government previously determined to be safe for the public and the environment. Such legislation – including the pertinent provisions in H.R. 1214 – would not require changing the RFS.

Fourth, EPA can use its waiver authority to lower renewable volume obligations to better reflect market realities. This would not require changing the RFS; indeed, such flexibility is built into the RFS.

As should be clear from the foregoing, such changes should – indeed must – include liability relief for retailers who follow the law.

9. *Have the 2017 and Later Model Years Light Duty Vehicle Greenhouse Gas Emissions and Corporate Average Fuel Economy standards for cars and light trucks changed the implementation outlook of the RFS?*

The CAFE standards might have the unintended consequence of impeding the achievement of the RFS' requirements. Under the RFS, a minimum of 36 billion gallons of qualified renewable fuels must be integrated into the motor fuels supply by 2022. This objective was expected to represent approximately 21-25% of the overall gasoline market. However, the proposed CAFE revisions could dramatically reduce the amount of motor fuel consumed in 2022 and beyond, creating a situation in which renewable fuels will be required to represent a significantly greater share of the market than originally anticipated. In addition, automobile companies may resort to engines with higher compression ratios, which in turn will require higher octane in the form of higher ethanol blends.

SIGMA is concerned that the policies being enacted and proposed at various levels of government are not being effectively coordinated. Improved efficiency, enhanced sustainability, national energy security, and economic growth are not mutually exclusive goals. However, if they are not pursued in a strategic, coordinated effort, they can lead to unintended consequences that can derail progress toward all of the objectives.

10. *What other methods, including the use of drop-in fuels, are available to ease the challenges posed by the blend wall?*

If and when drop-in fuels are available on a commercially viable basis, they could very well ease the challenges posed by the blend wall. However, at the present time drop-in fuels are not commercially viable.

11. *What are the impacts on renewable fuel producers if the RFS is changed to avoid the blend wall?*

SIGMA does not have a specific response to this question, other than to note that the impact on renewable fuel producers (and retailers) of any changes to the RFS will entirely depend on the scope and nature of those changes.

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If Congress is serious about new and alternative fuels entering the marketplace, it must take action to lower the cost of entry and remove the threat of unreasonable liability. Only then will more retailers be willing to take a risk and offer a new renewable fuel. By lowering the barriers to entry, Congress will give the market an opportunity to express its will and allow retailers to offer consumers more choice. This is what retailers want – consumer choice. If consumers reject the new fuel, the retailer can reverse the decision without sacrificing a significant investment, but new fuels will be given a better opportunity to successfully penetrate the market.

SIGMA greatly appreciates the opportunity to provide the foregoing analysis. SIGMA stands ready to assist the Committee in its consideration of policies that will promote a stable and efficient market for transportation fuels.

R. Timothy Columbus
General Counsel
Society of Independent Gasoline Marketers of America

April 5, 2013

Chairman Fred Upton &
Ranking Member Henry Waxman
Committee on Energy and Commerce
2125 Rayburn House Office Building
Washington, DC 20515

Dear Chairman Upton and Ranking Member Waxman:

On behalf of Underwriters Laboratories, Inc. (UL), I am responding to the Committee on Energy and Commerce's solicitation for comments on its "blend wall" white paper. The following comments reflect UL's experience regarding the use of higher concentrations of ethanol (above 10%) being used in commercially available motor vehicle fuels and the possible effects on automobile fuel storage and dispensing infrastructure.

UL is an independent, mission driven safety science organization dedicated to promoting safe living and working environments. Since our founding in 1894, UL's engineers and staff have helped develop safety standards and product-testing protocols, conducted independent product safety testing and certification, and inspected manufacturing facilities around the world. Through these and other activities, UL actively engages the US government in its development and administration of federal regulations and conformity assessment programs at the federal, state, and local levels. UL works with all participants as a neutral party to ensure the safest possible outcome for those who work with and rely on the products at issue. This work helps to both provide confidence to regulators that products meet requirements and enable market access for manufacturers' goods in the United States and abroad.

As the primary Nationally Recognized Testing Laboratory (NRTL) for equipment in this industry, UL certifies underground storage tanks, underground storage tank systems, and associated systems and equipment that dispense motor vehicle fuels. The UL Mark on or in connection with particular components or end products show that representative samples have been investigated by UL and found to be in compliance with the associated UL requirements. The UL Mark applies to the product as it is originally manufactured and for its intended use. When the manufacturer applies a UL-authorized UL Mark to a product, it represents the manufacturer's declaration that the product was manufactured in accordance with the applicable UL requirements for the intended use of such component or product.

In specific reference to the Committee's second and third questions regarding the risks and benefits of expanded use of ethanol blends greater than 10% on fuel related equipment, UL's extensive experience in providing safety certification for this equipment provides us with a unique perspective in assessing the impact of increased use of ethanol blends above 10% on these systems.

UL currently offers certification options for dispensing equipment that covers ethanol blends at levels up to E25 and E85. However, as noted in the Committee's white paper, most motor vehicle fuel pumps and many other fuel-dispensing related components and products are not approved to handle fuel blends containing higher than 10% ethanol. This is because research has shown that there may be some issues with equipment that was not designed with fuel blends containing more than 10% ethanol

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in mind. UL's research data suggests a particular concern with the degradation of gaskets, seals, and hoses when the elastomers used in these components were exposed to ethanol blends greater than 10%. The breakdown of the elastomers in these components has been demonstrated to cause leaks. If installed equipment has not been tested to relevant standards for higher level ethanol blends, the performance of the equipment under those conditions of use is not known. The US Environmental Protection Agency has issued a document addressing compatibility of underground storage tank systems (http://www.epa.gov/oust/altfuels/biofuelsguidance.htm) and this along with the particular manufacturer's instructions provide information for the user regarding how to properly use and maintain equipment for biofuel applications.

A publicly available example of the research UL has conducted in this area is a report ordered by the US Department of Energy (DOE) and the National Renewable Energy Laboratory (NREL) and released in September 2010. The project, *Dispensing Equipment Testing with Mid-Level Ethanol/Gasoline Test Fluid***,** was commissioned to help DOE and NREL better understand any potentially adverse impacts caused by a lack of knowledge about the compatibility of the dispensing equipment with ethanol blends higher than what the equipment was designed to dispense. The research is attached for your consideration. UL has also worked with NREL and industry to conduct testing research and to establish a related certification path for E15 dispenser retrofit equipment to support safe conversion of legacy motor vehicle fuel dispensing equipment to E15 service.

UL encourages the Committee to take into account the possible impact that the use of motor vehicle fuels blended with greater than 10% ethanol would have on fuel storage and dispensing equipment. While some of this equipment is certified for higher ethanol blends, much of the current automobile fueling infrastructure is not. The effect of using higher ethanol blends with this equipment not rated for such use raises issues of public safety that legislative, regulatory, and local installation authorities should consider.

UL would be pleased to speak with you further about our experience related to certification of fuel storage and dispensing equipment, with respect to both the scope of this white paper and related topics beyond that scope. Please contact me or Derek Larson, who is part of UL's Washington, DC-based Global Government Affairs team and can be reached at (202) 530-6168.

Sincerely,

August Schaefer
Senior Vice President &
Public Safety Officer

cc: Ann Weeks – Vice President, Global Government Affairs

Dispensing Equipment Testing With Mid-Level Ethanol/Gasoline Test Fluid

Summary Report

November 2010

Kenneth Boyce, Principal Engineer Manager – Energy
J. Thomas Chapin, Vice President – Corporate Research

Underwriters Laboratories Inc.
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Executive Summary

The National Renewable Energy Laboratory's (NREL) Nonpetroleum-Based Fuel Task is responsible for addressing the hurdles to commercialization of fuels and fuel blends such as ethanol that are derived from biomass. One such hurdle is the unknown compatibility of new fuels with current infrastructure, such as the equipment used at service stations to dispense fuel into automobiles. The U.S. Department of Energy's (DOE) Vehicle Technology Program and the Biomass Program have engaged in a joint project to evaluate the potential for blending ethanol into gasoline at levels higher than the present allowance of nominal 10 volume percent (E10).

This project was established to help DOE and NREL better understand any potentially adverse impacts caused by a lack of knowledge about the compatibility of the dispensing equipment with ethanol blends higher than what the equipment was designed to dispense. This report provides data about the impact of introducing a gasoline with a higher volumetric ethanol content into service station dispensing equipment from a safety and a performance perspective.

The project consisted of testing new and used equipment harvested from the field (all equipment UL listed for up to E10). Testing was performed according to requirements in Underwriters Laboratories Inc. (UL) Outline of Investigation for Power-Operated Dispensing Devices for Gasoline and Gasoline/Ethanol Blends With Nominal Ethanol Concentrations up to 85 Percent (E0-E85), Subject 87A, except using a CE17a test fluid based on the scope of this program. The primary focus was to identify leakage and assess other safety-related equipment performance as addressed by applicable UL requirements.

The overall results of the program were not conclusive insofar as no clear trends in the overall performance of all equipment could be established. New and used equipment such as shear valves, flow limiters, submersible turbine pumps, and hoses generally performed well. Some new and used equipment demonstrated a reduced level of safety or performance, or both, during either long-term exposure or performance tests. Dispenser meter/manifold/valve assemblies in particular demonstrated largely noncompliant results. Nozzles, breakaways, and swivels, both new and used, experienced noncompliant results during performance testing. Responses of nonmetals, primarily gaskets and seals, were involved with these noncompliances.

Acronyms and Abbreviations

ASTM	ASTM International
CE17a	Test fluid composed of predetermined amounts of aggressive ethanol and ASTM Reference Fuel C
EPA	U.S. Environmental Protection Agency
DOE	U.S. Department of Energy
NREL	National Renewable Energy Laboratory
SAE	Society of Automotive Engineers
UL	Underwriters Laboratories Inc.

Contents

Introduction

Background

The National Renewable Energy Laboratory's (NREL) Office of Deployment and Industry Partnerships and the Center for Transportation Technologies and Systems' Fuels Performance Group are responsible for addressing the hurdles to commercialization of fuels and fuel blends such as ethanol that are derived from biomass. One such hurdle is the unknown compatibility of new fuels with current infrastructure, such as the equipment used at service stations to dispense fuel into automobiles.

According to the U.S. Energy Information Administration, as of 2008 there were almost 162,000 retail gasoline outlets in the United States.[1] The equipment now in use consists of products from various manufacturers (some of which are no longer in business), of varying ages, maintained to varying degrees using different processes. The potential responses of the legacy base of installed fuel dispensing equipment to different fuel compositions such as E15 are unknown.

Purpose

This project used a systematic method to evaluate the performance of fuel dispensing equipment when exposed to a defined test fluid. The tests provide a methodology for assessing the equipment response to the predetermined test conditions, with a focus on loss of containment (leakage) and other safety-related performance issues.

In the equipment design process, materials are selected based on particular design considerations and performance requirements for the system. A key aspect of the selection is the compatibility of the materials (metals, plastics, and elastomers) with the fuel to which it will be exposed. Thus, an effective selection process is based on a comprehensive understanding of the material's mechanical, physical, and chemical properties. These materials are selected and used to produce component parts of equipment. The intended use of the equipment is a critical parameter for defining the required performance with regard to specific attributes.

In the case of fuel-dispensing equipment, materials that were selected—based on a characteristic compatibility with gasoline and gasoline/ethanol blends up to E10—may not exhibit the same compatibility with different fuel compositions. This program systematically evaluated the response of fuel dispensing equipment to exposure to ethanol/gasoline fuels with higher ethanol content by performing testing in the form of accelerated long-term exposure and subsequent assessment or safety performance.

Tests were conducted on new (previously unused) samples of equipment listed for gasoline and E10 use, and on used equipment that dispensed gasoline or E10 in the field. For harvested equipment, this testing was conducted to reflect a "second life" in dispensing a new fuel.

Test Items and Methods

Test Items

NREL identified and procured the equipment to be tested. Samples were subsequently delivered and prepared for test at the Underwriters Laboratories (UL) facility. A labeled photo of fueling equipment is available in Appendix B.

Selection

NREL identified test items based on discussions with a variety of stakeholders with knowledge of the practical use of fuel dispensing equipment. Stakeholders provided information about the prevalence of particular equipment in the marketplace, and about installation and maintenance conditions and experience. After their input was gathered and evaluated, specific pieces of equipment were targeted as preferred test items for the testing program.

Equipment samples of identified test items were obtained for testing from various sources. Used equipment was obtained from the marketplace based on availability. The used dispensers were employed in different geographic locations for varying durations and may have been subjected to variable levels of maintenance.

The selected test items were listed for use with gasoline and E10. The legacy standards used to evaluate these products specify the use of ASTM Reference Fuel H test fluid (85% ASTM Reference Fuel C and 15% nonaggressive ethanol).

Preparation

All samples were provided with closures to effectively seal all openings. Dispenser samples were modified to reduce their height to fit in the test chamber and to maximize test chamber space to generate data. Size reduction methods were selected to preserve as much as possible the integrity of the manufacturers' assembled connections, joints, seals, and structure.

Dispenser samples were configured for the Long-Term Exposure test with hanging hardware to simulate practical use and promote test efficiency. The hanging hardware consists of the breakaway coupling, flexible hose, swivel, and hose nozzle valve. After the Long-Term Exposure test, these samples were disassembled to perform applicable performance testing on the required equipment.

Test Methods

Test methods were based on established, recognized protocols that were modified to address the specific focus of this program.

Test Fluid

The tests were conducted using CE17a test fluid, as defined by NREL. The test fluid was based on the same standard used to evaluate material compatibility for flexible-fuel vehicles. A 17% ethanol volumetric concentration was selected to address E15 use. This was not a commercial fuel, but rather a test fluid selected for research purposes.

CE17a test fluid consists of a mixture of 83% ASTM Reference Fuel C and 17% aggressive ethanol. Reference Fuel C is a 50/50 v/v blend of isooctane and toluene. Aggressive ethanol as defined in SAE Publication J1681, Gasoline, Alcohol, and Diesel Fuel Surrogates for Materials Testing,[2] is a mixture of synthetic ethanol and the following aggressive elements in defined amounts: deionized water, sodium chloride, sulfuric acid, and glacial acetic acid. The added elements are representative of contaminants found in ethanol. The test fluids were prepared the same day they were used.

Test Methodology

Tests were conducted in accordance with the applicable methods specified in the Outline of Investigation for Power-Operated Dispensing Devices for Gasoline and Gasoline/Ethanol Blends With Nominal Ethanol Concentrations up to 85 Percent (E0-E85), Subject 87A,[3] except for the use of the CE17a test fluid. The testing methodology was developed with significant industry participation. These test criteria are defined to address reasonable safety of the equipment, focusing on loss of fuel containment and other safety-critical performance such as loss of ability to stop fuel flow or failure of breakaway couplings to separate at appropriate forces.[4] A brief summary of the test protocols follows; unless otherwise noted, references are to UL Subject 87A:

- Long-Term Exposure – Section 29. Samples were filled with test fluid and placed in a $60^{o}C \pm 2^{o}C$ chamber for 2,520 hours. A 50 psi leakage test was conducted weekly and the test fluid was replaced with fresh test fluid. Extracted test fluids were retained for subsequent analytical testing from one new and one used dispenser of similar design. Following Long-Term Exposure testing, samples were subjected to applicable performance tests depending on equipment type.
- High-Pressure Leakage Test – Section 30. Samples were subjected to a hydrostatic or aerostatic pressure of 150% of the rated value, but not lower than 75 psi.
- Meter Endurance – Section 31. Meter samples were operated at rated pressure for 300 hours, and then subjected to a leakage test at 150% of rated pressure, but not lower than 75 psi.
- Endurance Test – Pumps: Section 32. Pump samples were operated at the maximum discharge pressure developed by the pump for 300 hours.
- Hydrostatic Strength Test – Section 34. Samples were exposed to an internal hydrostatic pressure of 250 psi for 1 minute.
- Leakage and Electrical Continuity Test – Section 35. Hose samples were pressurized and the electrical resistance was measured.
- Hose Bending Test (Filled) – Section 36. Hose samples were filled with test fluid and subjected to a defined bending process for 3,150 cycles per day for 6 days.
- Low-Temperature Test – Section 37. Hose samples were filled with test fluid for conditioning for a specific duration, then drained and capped. Following the conditioning, the samples were placed in a chamber at $-40^{o}C$ to $\pm 2^{o}C$ for 16 hours, and subsequently bent around a mandrel with defined properties.

- Seat Leakage Test – Breakaway Couplings: Section 38. Breakaway coupling samples were uncoupled and subjected to a hydrostatic or aerostatic pressure of 150% of the rated value for 1 minute. The test was then repeated with a pressure of 0.25 psi.
- Operation Test – Electrically Operated Valves: Section 39. Electrically operated valve samples were connected to a test fluid system under rated pressure with the valve in the open position and fluid flowing, then the valve was closed to determine if there was continued fluid flow.
- Electrical Continuity Test – Section 42. The electrical resistance across the element was measured.
- Pull Test – Breakaway Couplings: Section 43. Breakaway coupling samples were subjected to a pull force to verify that they would separate at a force value not more than the rated value and not less than 100 pounds.
- Endurance Test – Breakaway Couplings: Section 44. Reconnectable breakaway coupling samples were subjected to 100 cycles of separation and reconnection.
- Operation Test – Swivel Connectors: Section 45. Swivel connector samples were subjected to 100,000 cycles of operation under defined conditions.
- Endurance Test – Hose Nozzle Valve: Section 46. Hose nozzle valve samples were subjected to 100,000 cycles of operation.
- Pull Test – Hose Assemblies: Section 49. Hose assembly samples with end couplings were subjected to a 400-pound pull force.
- Shear Section – Section 61. Shear valve samples were subjected to a bending moment of not more than 650 pound-feet to verify the valve would close.
- Ozone Test – Section 62. Specimens from hose samples were exposed to ozone for 70 hours and examined for cracking.
- Dielectric Strength – UL 79, Section 61. Pump samples were subjected to a 60 Hz potential of 1,460 V applied between live electrical parts and dead metal for a period of 1 minute.

Equipment testing is typically terminated when a noncompliance is noted. However, in the interest of gathering the most data possible, testing after a noncompliance was continued to the degree possible in this program. In some cases, test results are interdependent and the root cause of noncompliances in one test may lead to noncompliances in others.

Results

Table 1 contains a summary of the test results observed on the new dispenser samples and dispensing equipment subassemblies. Dispenser samples were configured with hanging hardware for the Long-Term Exposure Test.

Table 1. Tests on New Samples

Sample	Tests Conducted	Results
Dispenser #1	Long-Term Exposure High-pressure Leakage	Compliant Compliant
Meter/manifold/electric valve assembly #1	Long-Term Exposure High-Pressure Leakage Meter Endurance	Compliant Compliant Noncompliant. Leakage noted during endurance test from meter and valve seals. As a result, no further testing could be conducted.
Dispenser #2	Long-Term Exposure High-Pressure Leakage	Compliant Compliant
Meter/manifold/electric valve assembly #2	Long-Term Exposure High-Pressure Leakage Meter endurance	Compliant Compliant Noncompliant. Leakage noted during endurance test from valve seals. As a result, no further testing could be conducted.
Breakaway #1 (reconnectable)	Long-Term Exposure High-Pressure Leakage Seat Leakage Pull Endurance Hydrostatic Strength Electrical Continuity	Compliant Compliant Compliant Compliant Noncompliant. Poppet disengaged and leakage noted. Compliant Compliant
Breakaway #2 (reconnectable)	Long-Term Exposure High-Pressure Leakage Pull Test Seat Leakage Endurance High-Pressure Leakage (repeated) Seat Leakage Pull (repeated) Hydrostatic Strength Electrical Continuity	Compliant Compliant Compliant Compliant Compliant Compliant Noncompliant. Leakage noted. Compliant Inconclusive. Sample separated at 180 psi and could not reach 250 psi test pressure Compliant

Sample	Tests Conducted	Results
Breakaway #3 (reconnectable)	Long-Term Exposure High-Pressure Leakage Seat Leakage Pull Endurance High-Pressure Leakage (repeated) Seat Leakage (repeated) Hydrostatic Strength Electrical Continuity	Compliant Compliant Compliant Compliant Noncompliant. Poppet o-ring displaced and leakage noted. Compliant Noncompliant. Leakage noted. Inconclusive. Sample separated at 178 psig and could not reach test pressure. Compliant
Breakaway #4 (non-reconnectable)	Long-Term Exposure High-Pressure Leakage Pull Seat Leakage Electrical continuity	Compliant Compliant Compliant Compliant Compliant
Breakaway #5 (non-reconnectable)	Long-Term Exposure High-Pressure Leakage Pull Seat Leakage Electrical Continuity	Compliant Compliant Compliant Compliant Compliant
Flow Limiter #1	Long-Term Exposure High-Pressure Leakage Hydrostatic Strength Electrical Continuity	Compliant Compliant Compliant Compliant
Hose Assembly #1	Long-Term Exposure Leakage and Electrical Continuity Hydrostatic Strength Ozone	Compliant Compliant Compliant Compliant
Hose Assembly #2	Long-Term Exposure Leakage and Electrical Continuity Pull Hydrostatic Strength	Compliant Compliant Compliant Compliant
Hose Assembly #3, with integral swivel	Long-Term Exposure High-Pressure Leakage Swivel Operation High-Pressure Leakage (repeated) Leakage and Electrical Continuity Hydrostatic Strength Ozone	Compliant Compliant Compliant Compliant Compliant Compliant Compliant
Hose Assembly #4	Long-Term Exposure Leakage and Electrical Continuity Pull	Compliant Compliant Compliant
Hose Assembly #5	Long-Term Exposure Leakage and Electrical Continuity Pull	Compliant Compliant Compliant

Sample	Tests Conducted	Results
Hose Assembly #6	Long-Term Exposure Leakage and Electrical Continuity Hydrostatic Strength Ozone	Compliant Compliant Compliant Compliant
Hose assembly #7	Long-Term Exposure Leakage and Electrical Continuity Hydrostatic Strength Ozone	Compliant Compliant Compliant Compliant
Hose assembly #8	Long-Term Exposure Leakage and Electrical Continuity Hydrostatic Strength Ozone	Noncompliant. Ferrule started leaking during pressure testing in week 8 of long-term exposure. Compliant Compliant Compliant
Hose #9	Hose Bending Test (Filled) Leakage and Electrical Continuity Low Temperature	Compliant Compliant Compliant
Nozzle #1	Long-Term Exposure High-Pressure Leakage Endurance High-Pressure Leakage (repeated) Hydrostatic Strength Electrical Continuity	Compliant Compliant Inconclusive; nozzle shut off flow after approx. 14,000 cycles of endurance and would not allow further flow. As observed the test terminated in a safe condition. Compliant Compliant Compliant
Nozzle #2	Long-Term Exposure High-Pressure Leakage Endurance High-Pressure Leakage (repeated) Hydrostatic Strength Electrical Continuity	Compliant Compliant Compliant Compliant Compliant Compliant
Nozzle #3	Long-Term Exposure High-Pressure Leakage Endurance High-Pressure Leakage (repeated) Hydrostatic Strength Electrical Continuity	Compliant Compliant Inconclusive; nozzle shut off flow after approx. 83,000 cycles of endurance and would not allow further flow. As observed the test terminated in a safe condition. Noncompliant. Leakage noted. Compliant Compliant
Nozzle #4	Long-Term Exposure High-Pressure Leakage Endurance High-Pressure Leakage (repeated) Hydrostatic Strength Electrical Continuity	Compliant Compliant Compliant Noncompliant. Leakage noted. Compliant Compliant

Sample	Tests Conducted	Results
Nozzle #5	Long-Term Exposure High-Pressure Leakage Endurance High-Pressure Leakage (repeated) Hydrostatic Strength Electrical Continuity	Compliant Compliant Compliant Compliant Compliant Compliant
Nozzle #6	Long-Term Exposure High-Pressure Leakage Endurance High-Pressure Leakage (repeated) Hydrostatic Strength Electrical Continuity	Compliant Noncompliant. Leakage noted. Compliant Noncompliant. Leakage noted. Compliant Compliant
Shear Valve #1	Long-Term Exposure High-Pressure Leakage Hydrostatic Strength Shear Section	Compliant Compliant Compliant Compliant
Shear Valve #2	Long-Term Exposure High-Pressure Leakage Hydrostatic Strength Shear Section	Compliant Compliant Compliant Compliant
Shear Valve #3	Long-Term Exposure High-Pressure Leakage Hydrostatic Strength Shear Section	Compliant Compliant Compliant Compliant
Submersible turbine pump #1	Long Term Exposure Hydrostatic Strength Dielectric Strength	Compliant Inconclusive. Required test pressure could not be applied based on sample configuration. Compliant
Swivel #1	Long-Term Exposure High-Pressure Leakage Operation High-Pressure Leakage (repeated) Hydrostatic Strength Electrical Continuity	Compliant Compliant Compliant Compliant Compliant Compliant
Swivel #2	Long-Term Exposure High-Pressure Leakage Electrical Continuity Operation High-Pressure Leakage (repeated) Hydrostatic Strength Electrical Continuity	Compliant Compliant Compliant Compliant Compliant Compliant Compliant
Swivel #3	Long-Term Exposure High-Pressure Leakage Operation High-Pressure Leakage (repeated) Hydrostatic Strength Electrical Continuity	Compliant Compliant Noncompliant. Leakage noted after approximately 26,000 cycles on swivel nut. Noncompliant – leakage noted at swivel nut. Compliant Compliant

Table 2 contains a summary of the test results observed on used dispensers and dispensing equipment subassemblies.

Table 2: Tests on Used Samples

Sample	Tests Conducted	Results
Dispenser #3	Long-Term Exposure High-Pressure Leakage	Compliant Compliant
Meter/manifold/electric valve assembly #3	Long-Term Exposure High-Pressure Leakage Meter Endurance High-Pressure Leakage repeated Hydrostatic Strength Operation Test – Electrically Operated Valves	Compliant Compliant Compliant Compliant Compliant Noncompliant. Valve did not shut off flow.
Nozzle #7	Long-Term Exposure High-Pressure Leakage Endurance High-Pressure Leakage (repeated) Hydrostatic Strength Electrical Continuity	Noncompliant. Leakage noted during pressure testing starting in week 10 of long-term exposure. Noncompliant. Leakage noted. Noncompliant; 100,000 cycles completed but leakage noted. Noncompliant. Leakage noted. Compliant Compliant
Breakaway #6 (reconnectable)	Long-Term Exposure High-Pressure Leakage Seat leakage Pull Test Endurance Seat Leakage Electrical Continuity	Compliant Compliant Compliant Compliant Noncompliant. Seat leakage noted at 71 cycles. Noncompliant. Leakage noted. Compliant
Hose assembly #10	Long-Term Exposure Leakage and Electrical Continuity Pull	Compliant Compliant Compliant
Hose assembly #11, with integral swivel	Long-Term Exposure Swivel Operation Leakage and Electrical Continuity Hydrostatic Strength Ozone	Compliant Compliant Compliant Compliant Compliant
Dispenser #4	Long-Term Exposure High-Pressure Leakage	Compliant Compliant
Meter/manifold/electric valve assembly #4	Long-Term Exposure High-Pressure Leakage Meter Endurance	Compliant. Compliant Noncompliant. Leakage noted during endurance test from meter and valve seals. As a result, no further testing could be conducted.

Sample	Tests Conducted	Results
Nozzle #8	Long-Term Exposure	Noncompliant. Seat leakage noted during pressure testing in week 9 of long-term exposure.
	High-Pressure Leakage	Noncompliant. Leakage noted.
	Endurance	Noncompliant; 100,000 cycles completed but seat leakage noted
	High-Pressure Leakage (repeated)	Noncompliant. Leakage noted
	Hydrostatic Strength	Compliant
	Electrical Continuity	Compliant
Breakaway #7 (reconnectable)	Long-Term Exposure	Compliant
	High-Pressure Leakage	Compliant
	Seat Leakage	Compliant
	Pull	Noncompliant. Separated above rated value.
	Endurance	Compliant
	High-Pressure Leakage (repeated)	Compliant
	Seat Leakage	Compliant
	Pull (repeated)	Compliant
	Electrical Continuity	Compliant
	Hydrostatic Strength	Inconclusive. Sample separated at 208 psig and could not reach test pressure
Hose assembly #12	Long-Term Exposure	Compliant
	Leakage and Electrical Continuity	Compliant
	Pull	Compliant
Hose assembly #13, with integral swivel	Long-Term Exposure	Compliant
	Swivel Operation	Compliant
	Leakage and Electrical Continuity	Compliant
	Hydrostatic Strength	Compliant
	Ozone	Noncompliant; cracking noted
Dispenser #5	Long-Term Exposure	Compliant
	High-Pressure Leakage	Compliant
Meter/manifold/electric valve assembly #5	Long-Term Exposure	Compliant
	High-Pressure Leakage	Compliant
	Meter Endurance	Noncompliant. Leakage noted at valve seal. As a result, no further testing could be conducted.
Nozzle #9	Long-Term Exposure	Compliant
	High-Pressure Leakage	Compliant
	Endurance	Compliant
	High-Pressure Leakage (repeated)	Compliant
	Hydrostatic Strength	Compliant
	Electrical Continuity	Compliant
Breakaway #8 (reconnectable)	Long-Term Exposure	Compliant
	High-Pressure Leakage	Compliant
	Seat Leakage	Compliant
	Pull Test	Noncompliant. Separated above rated value. After separation, sample could not be reassembled to complete other tests.
	Electrical Continuity	Compliant

Sample	Tests Conducted	Results
Swivel #4	Long-Term Exposure High-Pressure Leakage Operation Test High-Pressure Leakage (repeated) Hydrostatic Strength Electrical Continuity	Compliant Compliant Noncompliant. Body joint leaked after approximately 62,000 cycles. Swivel nut leaked after approximately 12,200 cycles. Compliant Compliant Compliant
Hose assembly #14, with integral swivel	Long-Term Exposure High-Pressure Leakage Swivel Operation High-Pressure Leakage (repeated) Hydrostatic Strength Leakage and Electrical Continuity Ozone	Noncompliant. Ferrule started leaking during pressure testing in week 7 of long-term exposure. Compliant Compliant Compliant Compliant Compliant Noncompliant – cracking noted
Dispenser #6	Long-Term Exposure High-Pressure Leakage	Compliant Compliant
Meter/manifold/electric valve assembly #6	Long-Term Exposure High-Pressure Leakage Meter Endurance	Compliant Compliant Noncompliant. Leakage noted during endurance test from meter and valve seals. As a result, no further testing could be conducted.
Nozzle #10	Long-Term Exposure High-Pressure Leakage Endurance Test Hydrostatic Strength Electrical Continuity	Compliant Compliant Noncompliant. Seat leakage noted and automatic shutoff not operating after approx. 61,000 cycles of Endurance Test. Compliant Compliant
Breakaway #9 (non-reconnectable)	Long-Term Exposure High-Pressure Leakage Seat Leakage Electrical Continuity	Compliant Compliant Compliant Compliant
Swivel #5	Long-Term Exposure High-Pressure Leakage Operation Test High-Pressure Leakage (repeated) Hydrostatic Strength Electrical Continuity	Compliant Compliant Noncompliant; swivel nut leaked after approximately 3000 cycles. Testing on body joint was compliant. Compliant Compliant Compliant
Hose Assembly #15	Long-Term Exposure Leakage and Electrical Continuity Pull Hydrostatic Strength	Compliant Compliant Compliant Compliant

Analysis

An exhaustive literature search was conducted on gasoline and gasoline-ethanol blended fuel compatibility with fuels infrastructure materials and equipment. From this investigation, numerous published reports have demonstrated that exposure to fuels such as ethanol/gasoline blends may affect materials that come into contact with the fuel. This may affect the performance of a formed part (such as a gasket) manufactured from such materials. The formed part may be affected to the degree that it modifies equipment performance with respect to a critical property. In this case, a change in equipment performance or safety may be noted. For this program, a change in equipment performance was gauged by response to the defined test conditions.

Table 3 summarizes the performance of different types of equipment in the testing program.

Table 3: Summary of Test Results on Different Types of Equipment

Equipment	Compliant Test Results on New Samples[a]	Compliant Test Results on Used Samples[a]	Overall Compliant Test Results[a]
Breakaways	2 of 5	1 of 4	3 of 9
Flow Limiters	1 of 1	–	1 of 1
Hoses/Hose Assemblies	8 of 9	4 of 6	12 of 15
Meter/Manifold/Valve Assemblies	0 of 2	0 of 4	0 of 6
Nozzles	3 of 6	1 of 4	4 of 10
Shear Valves	3 of 3	–	3 of 3
Submersible Turbine Pumps	1 of 1	–	1 of 1
Swivels[b]	3 of 4	3 of 5	6 of 9

[a]In the context of Table 3, "compliant" results is used to include fully compliant test results and inconclusive test results that did not directly manifest a hazard such as leakage during the testing that was able to be performed as a part of this research program.

[b] Includes swivels integral to hose assemblies.

For equipment with noncompliant test results, few leakages occured during the Long-Term Exposure test. The majority of leakages occurred during performance testing. These results may indicate that exposing some equipment to fuel blends with higher ethanol content may not produce an immediate or short-term response that would result in a leakage. However, this equipment may still demonstrate reduced effective life and in time lead to a reduced level of safety as assessed in the subsequent performance testing.

Some equipment, both new and used, demonstrated performance during and after the Long-Term Exposure test that indicated a reduced level of safety or efficacy, or both. These data indicate that some pieces of equipment in the legacy base of installed gasoline dispensing equipment may be adversely affected by exposure to fuel with higher ethanol content. During this testing program, a number of leakages and other noncompliant results were noted on new and used equipment harvested from the field. Leakages are largely attributed to effects of exposure on the gasket and seal materials. The only exceptions were cases in which a polymeric component of a breakaway coupling was degraded and the damage resulted in a consequential leakage.

Gaskets

Exposure to gasoline/ethanol blends may cause gasket and seal materials to swell[4] or otherwise be affected. Although mild swelling may produce the short-term effect of a tighter seal, it is indicative of a material response to exposure that may have long-term consequences for seal performance. Previous studies[6] identified volume swelling as one of the most critical measurements when considering tolerances for elastomeric seal housing design; swelling of elastomers greater than 20% have reportedly caused several problems, including overfill of the seal housing groove, seal extrusion damage, extremely high stresses in the seal and in the housing, occasional fracture of metal components, and progressive degradation of elastomers. Studies[7] have also established that elastomers demonstrate increased permeability of gasoline/ethanol blends with increasing ethanol content. Permeation may in turn lead to extraction of organic compounds from exposed nonmetals. In the case of fillers and other compounds that are introduced into the gasket or seal for a specific performance attribute, such extraction may fundamentally alter the material and the corresponding performance of the formed part.

Depending on the configuration, fuel dispensers may contain 20 to 60 (or more) gaskets and seals. Many equipment manufacturers use a variety of gasket materials in their ongoing production of specific pieces of equipment, with potential variations in sourcing over time and different manufacturing locations. The field population of a specific piece of equipment designed for use with gasoline and E10 may incorporate a variety of gasket materials. In the past, these materials were generally selected based on their compatibility with gasoline and E10. The materials may demonstrate varying compatibility with higher ethanol fuel blends.

Metallic Parts

In this study, there was no noted effect on metallic parts of equipment. The lack of galvanic interaction or other significant corrosion is consistent with the relatively lower ethanol content of E15 fuel serving as the subject of this study and corresponding lower electrical conductivity, compared to higher ethanol fuel blends such as E85.

Used Equipment

Used equipment has already been subjected to a useful life, which reflects its unique conditions of use and maintenance. Use conditions may vary widely with respect to temperature, fuels the equipment dispensed, duration of use, conditions of practical use, and similar environmental conditions. Maintenance conditions such as adherence to applicable schedules and field modification of the equipment also may vary widely. Based on these practical issues, the response of used equipment to the prescribed test conditions may be inherently variable. Some used equipment demonstrated noncompliant results in this test program. However, various pieces of used subassemblies completed the testing with fully compliant results. In all cases, if legacy dispensers were to be exposed to fuel blends with higher ethanol content, effective supervision, maintenance, and inspection regimes will be important to effectively monitor the equipment’s response to the different conditions of use and proactively minimize the occurrence of hazards.

Breakaways

The breakaway coupling samples demonstrated varying performance in the test program. Three of the nine samples tested, and two of the five new samples, yielded compliant results. All three non-reconnectable samples yielded compliant results. Two cases of noncompliant results were for reconnectable breakaways, in which the poppet was dislodged during endurance and caused containment loss; a more appropriate poppet material would be expected to produce better practical results. Only one of the four used samples produced compliant results. Two noncompliances were noted for the pull test force on used samples. Two instances of seat leakage were noted on one new and one used sample; more appropriate sealing methods for the seat would be expected to produce better practical results in these cases.

Flow Limiter

The flow limiter sample yielded fully compliant results.

Hoses

Hoses and hose assemblies, both new and used, fared well overall. Twelve of the 15 samples, and eight of the nine new samples, complied with all tests that were performed. Thirteen of the 14 samples yielded results on the hoses that were compliant. Of the three samples that produced noncompliant results, two leaked at the fitting ferrule, and one used sample yielded noncompliant results in the ozone test. In the cases involving leaks at the ferrule, a more appropriate sealing method would be expected to produce better practical results.

Meter/Manifold/Valve Assemblies

The meter/manifold/valve assemblies demonstrated noncompliant results in the six dispensers tested. In five cases, the meter cover seal leaked; in the sixth, the electric valve lost its ability to shut off the flow of fuel. These data indicate that gasket and seal materials used in these applications may be particularly affected by exposure to fuel blends with greater ethanol content. The seal materials used in this part of the hydraulic tree may require careful consideration if fuel blends with higher ethanol content are used.

Nozzles

The nozzle samples demonstrated varying performance in the test program. Four of the 10 samples tested, and three of the six new samples, yielded compliant results or results that did not involve containment loss. Five of the six noncompliant results noted involved leakage, including seat leakage; more appropriate sealing methods would be expected to produce better practical results. Only one of the four used samples produced compliant results.

Shear Valves

The three new shear valve samples demonstrated compliant results in all cases.

Swivels

The swivel samples demonstrated varying performance. Six of the nine samples tested yielded compliant results. Three of the four new samples were compliant; this may indicate that more recent designs are better suited to anticipate use with E15 fuel. Three of the five used samples produced compliant results. All three noncompliant results noted involved leakage that started during the operation test. More appropriate seal materials would be expected to produce better practical results.

Submersible Turbine Pumps

The submersible turbine pump sample tested demonstrated compliant results for the long-term exposure and dielectric strength test. The hydrostatic strength test yielded inconclusive results because the required test pressure could not be applied based on the test sample configuration; however, no noncompliant results were noted. These data do not demonstrate an incompatibility of the test item with E15, and the Long-Term Exposure test was successfully completed.

Conclusion

The overall results of the program were not conclusive insofar as no clear trends in the overall performance of all equipment could be established.

Various pieces of new and used dispensing equipment demonstrated compliant results. Shear valve and flow limiter test items produced compliant results, the submersible turbine pump performed well, and hoses generally yielded compliant results.

Some equipment with noncompliant results did not leak during the Long-Term Exposure test. These results may indicate that exposing some equipment to fuel blends with higher ethanol content may or may not produce an immediate or short-term response that would cause leakage. However, this equipment may still demonstrate reduced effective life and in time lead to a reduced level of safety as assessed in the subsequent performance testing.

Some equipment, both new and used, demonstrated performance during and after the Long-Term Exposure test that indicated a reduced level of safety or performance, or both. These pieces of equipment demonstrated limited ability to safely accommodate exposure to fuels such as E15 with higher ethanol content. Responses of nonmetals to exposure—notably gaskets and seals, but also polymeric parts—were involved with these noncompliances. Dispenser meter/manifold/valve assemblies in particular demonstrated largely noncompliant results; the seal materials used in this portion of the hydraulic tree may require careful consideration if fuel blends with higher ethanol content are used.

Analysis of the extracted test fluids may provide additional insight into the chemical interactions of the test fluids, materials, and the corresponding degradation mechanisms; analysis results are available in Appendix A. Because of the specific nature and goals defined for this program, a finite number of test items were employed. Testing of other items to establish a larger sample size may provide additional insights. Further detailed analysis of the equipment that produced compliant results may establish best practices; conversely, further detailed analysis of the equipment that produced noncompliant results may further identification of root causes of equipment design that may lead to leakages or other potential risks. This work is ongoing and will be reported separately.

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Appendix A

Fluid Analysis Summary for Dispensers 1 and 5

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Mike Kass, Tim Theiss, Sam Lewis and John Storey

During the 15-week conditioning phase of UL Subject 87A, spent fluid samples were extracted from dispensers #1 and #5 for analysis by Oak Ridge National Laboratory (ORNL). Dispenser 1 was a new dispenser while Dispenser 5 has a similar design and was used for five years. The fuel dispensing history of Dispenser 5 is unknown. During the evaluation, the fluids within the dispensers were replaced once per week for 15 weeks. A control fuel sample and tested samples from weeks 1, 2, 3, 4, 8, 10, 12 and 15 were sent to ORNL for analysis. Photographs showing the fluid coloration with sample times are shown in Figures 1 and 2 for Dispensers 1 and 5, respectively. Both sets of fluids exhibited an amber coloration during the first week of experimentation, in contrast to the control fluid, which is clear. In general, the color becomes less pronounced and more clear as the test period progresses. The fluid in Dispenser 1 retains the amber color into week 12, while the fluid extracted from Dispenser 5 loses the amber coloration around week 8. The fuel sample for week 15 for Dispenser 1 is noteworthy in that it did not follow the observed trend and exhibited a clear coloration for week 15. Analysis revealed that this sample was chemically identical to control specimen (uncontaminated CE17a). The results may potentially be attributed to a sample handling error.

The fluids were analyzed using a gas chromatography-mass spectrometer (GC-MS). GC-MS is an established analytical technique for analysis of hydrocarbon compounds in fluid-based samples. Representative GC-MS spectra for fluids extracted from Dispenser 1 and 5 are shown in Figures 3 and 4, respectively. The spectra reveal key differences between the two samples. As shown in Figure 3, fluid extracted from Dispenser 1 (a new unit) showed clear identifiable peaks associated with phthalate and polymer compounds. In contrast, the spectra shown in Fig. 4 for the fluid pulled from the used Dispenser 5 was heavily contaminated with kerosene. The presence of high kerosene levels is a strong indicator that this dispenser unit had been used to dispense kerosene at some point in its operational lifetime. Unfortunately, because the kerosene concentration was so high, any phthalate or polymer compounds that may have been present in the fluid samples would be masked out by the kerosene. Therefore, we cannot state with any certainty whether dissolved phthalates or polymers were present in the fluid samples for Dispenser 5.

The phthalates observed in the Dispenser 1 fluid samples are commonly added to dispenser hoses, and to a lesser extent in the o-rings and gaskets to increase flexibility and durability. Because phthalates are not covalently bonded to the polymer structure, they are highly susceptible to leaching and removal by fluids that are capable of penetrating into the polymer structure. The phthalate concentration as a function of week of exposure to CE17a test fluid is shown in Fig. 3 for Dispenser 1. Except for week 12, the phthalate level decreased with exposure indicating that the phthalate concentration in the diffusion region of the elastomer was decreasing with time. The results may potentially be attributed to a sample handling error.

On the other hand, the decrease in phthalate concentration with sampling time can be attributed to two compounding reasons. First, the level of available phthalates in the elastomer decreases with exposure time as the phthalates are leached away and, secondly, the diffusion distance for the fluid to permeate into the elastomer to reach and dissolve the phthalate compounds also increases, thereby reducing phthalate removal. Because the phthalates are added to polymers to impart flexibility and durability, their removal will result in a stiffer component that is susceptible to cracking when flexed. We cannot state without further investigation whether the phthalate removal was caused by a single component or interaction of the CE17a ingredients. However, results from the ORNL stir-tank materials study have shown that the volume swell (a measure of permeation) for polymers increased with the addition of the aggressive ethanol in most cases.

The sample fluid from Dispenser 1 also contained high concentrations of polymer fragments indicative of fractured molecules of elastomers and rubber seals (see Fig. 4). The longer hydrocarbon chain lengths of the elastomer molecules are too large to be detected using GC-MS; however, fractured elements of the elastomer, such as hexanoic acid (shown in Fig. 4), were detected. The ester and ether molecular groups can be cleaved from the extended hydrocarbon structure through a hydrolysis reaction involving an acid acting as catalyst. Because the hydrolysis reaction requires an acid catalyst to cleave the polymer into the resulting hexanoic acid fragments, the acetic and sulfuric acid components of the test fluid are likely responsible for polymer fragmentation and subsequent detection. The resulting fragments are themselves acids and serve to propagate the hydrolysis reaction. Polymer fractionation and dissolution would eventually lead to structural damage and a weakening of gaskets or o-rings. Prolonged exposure would result in gap formation between the gasket and sealed sections leading to fluid leakage.

ORNL concludes that polymer degradation was caused primarily by the acid constituents of the aggressive ethanol. There was some discussion as to whether the 60^{o}C operating temperature was responsible for the noted polymer degradation, but the observed polymer hydrolysis fractionation cannot be attributed to temperature alone. Thermal-based reactions would result in increased crosslinking and not cleavage of the hydrocarbons chains. Additionally, thermal oxidation of the hydrocarbons would result in the formation of CO, CO_2, H_2O, and partially oxidized hydrocarbons (soot). However, the temperatures needed to promote thermal oxidation of the elastomers would be expected to exceed 60^{o}C and no partially oxidized hydrocarbons of either the fuel or the polymers were detected.

Because the kerosene contamination in the Dispenser 5 fluid samples was so high, we were unable to identify any peaks associated with phthalate compounds or polymer fractions. Therefore, we had to rely on the Dispenser 1 fluid samples to assess potential interactions between the test fuel and dispenser materials (especially elastomers). The fluid samples contained large levels of phthalates and fractionated polymers (hexanoic acid, etc.). The presence of phthalates indicates that the fluids were able to penetrate into the elastomer structure and remove the phthalate compounds which were added to improve flexibility. As a result the elastomers can be expected to have reduced durability.

The presence of hexanoic acid is a strong indication that the weak acids present in the test fuels were able to hydrolyze and break down the molecular structure of the gasket and seal materials. Either of these two effects will degrade the physical properties of the elastomers used in the gaskets, o-rings, seals, etc. and would eventually lead to leakage.

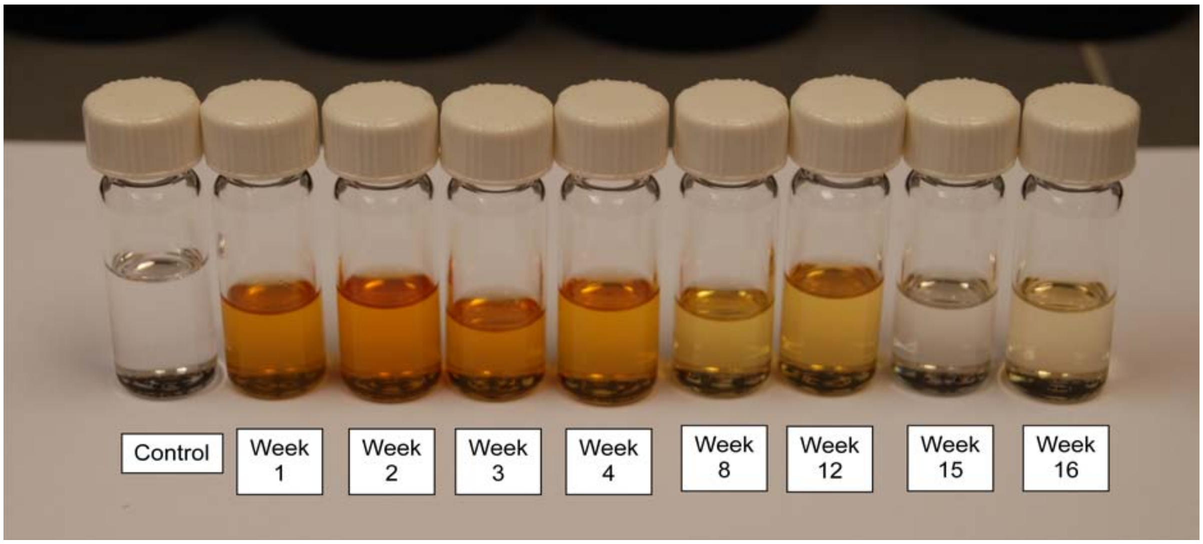


Figure. 1. Photograph showing the weekly change in appearance of fluid extracted from Unit 1.

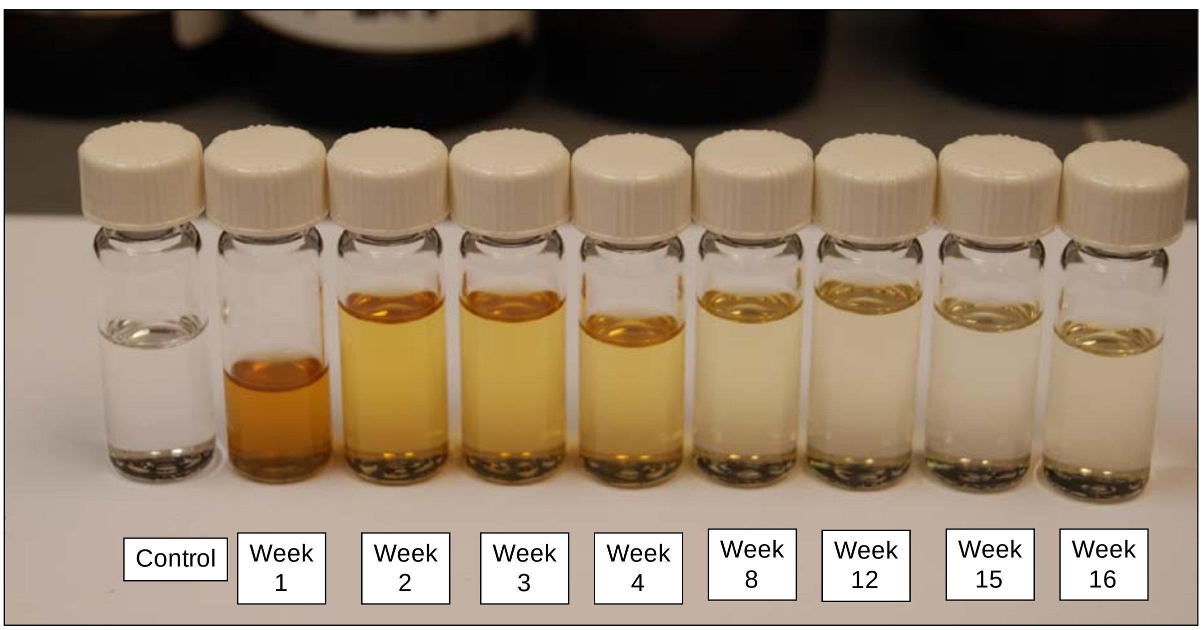


Figure 2. Photograph showing the weekly change in appearance of fluid extracted from Unit 5.

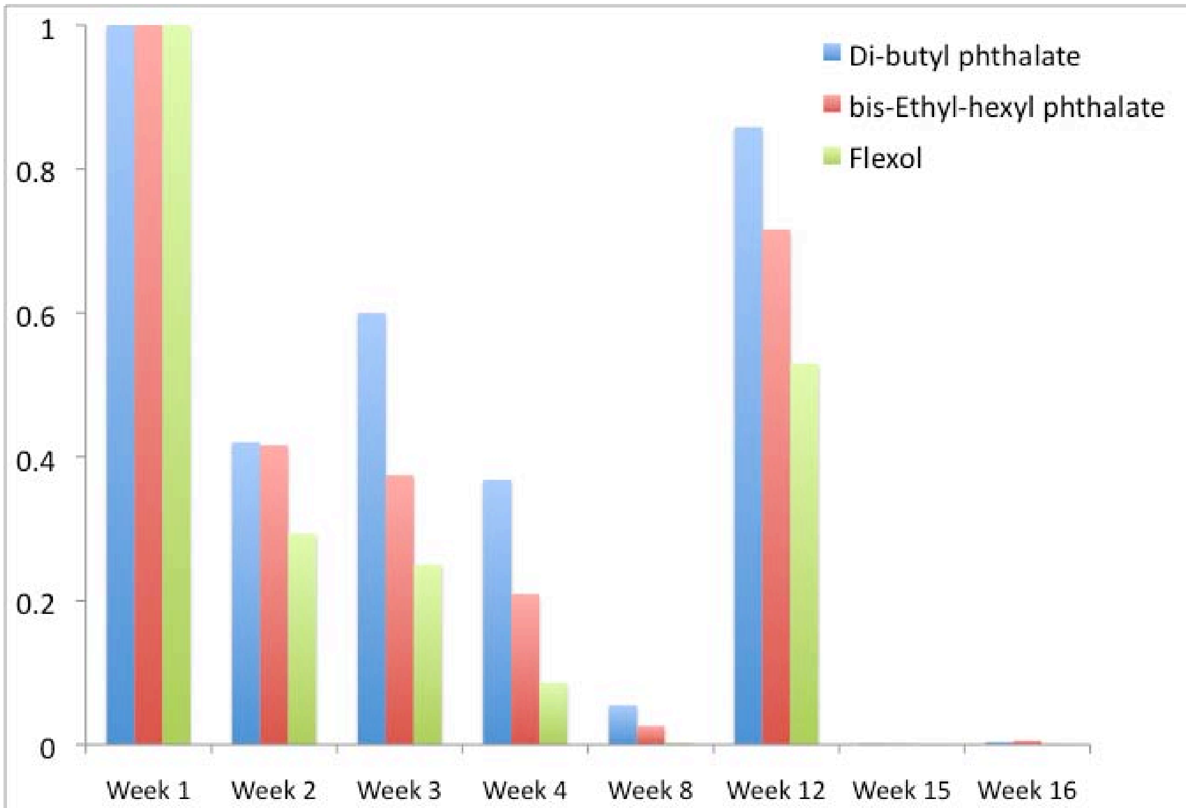


Figure. 3. Phthalate concentration as a function of sample time for fluid samples extracted from Dispenser 1.

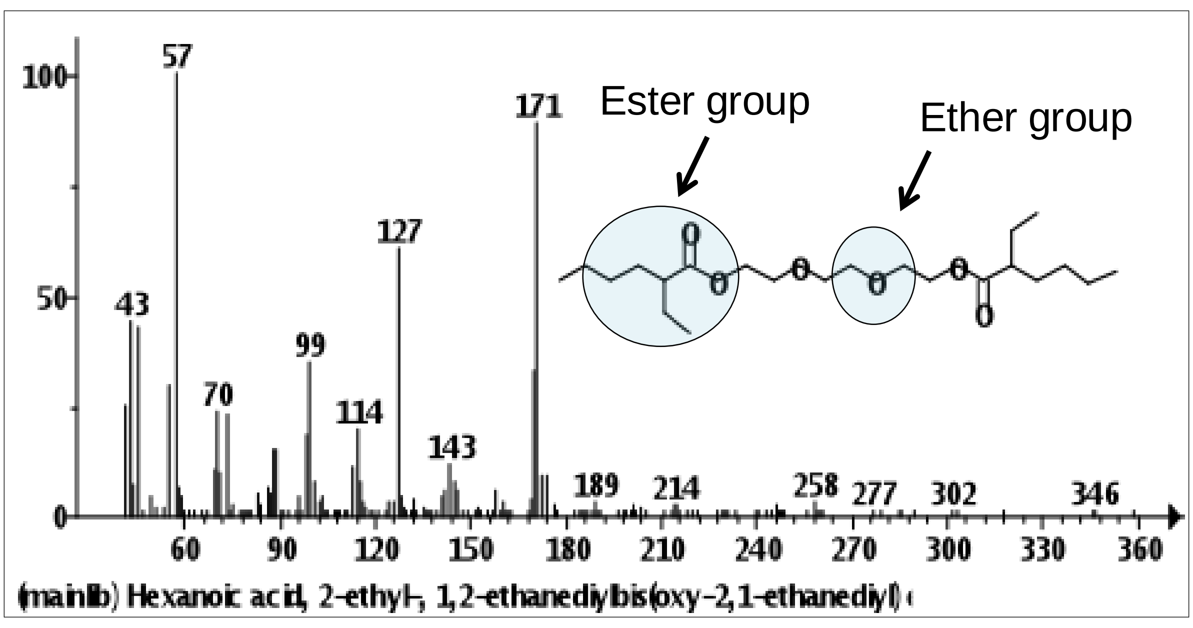
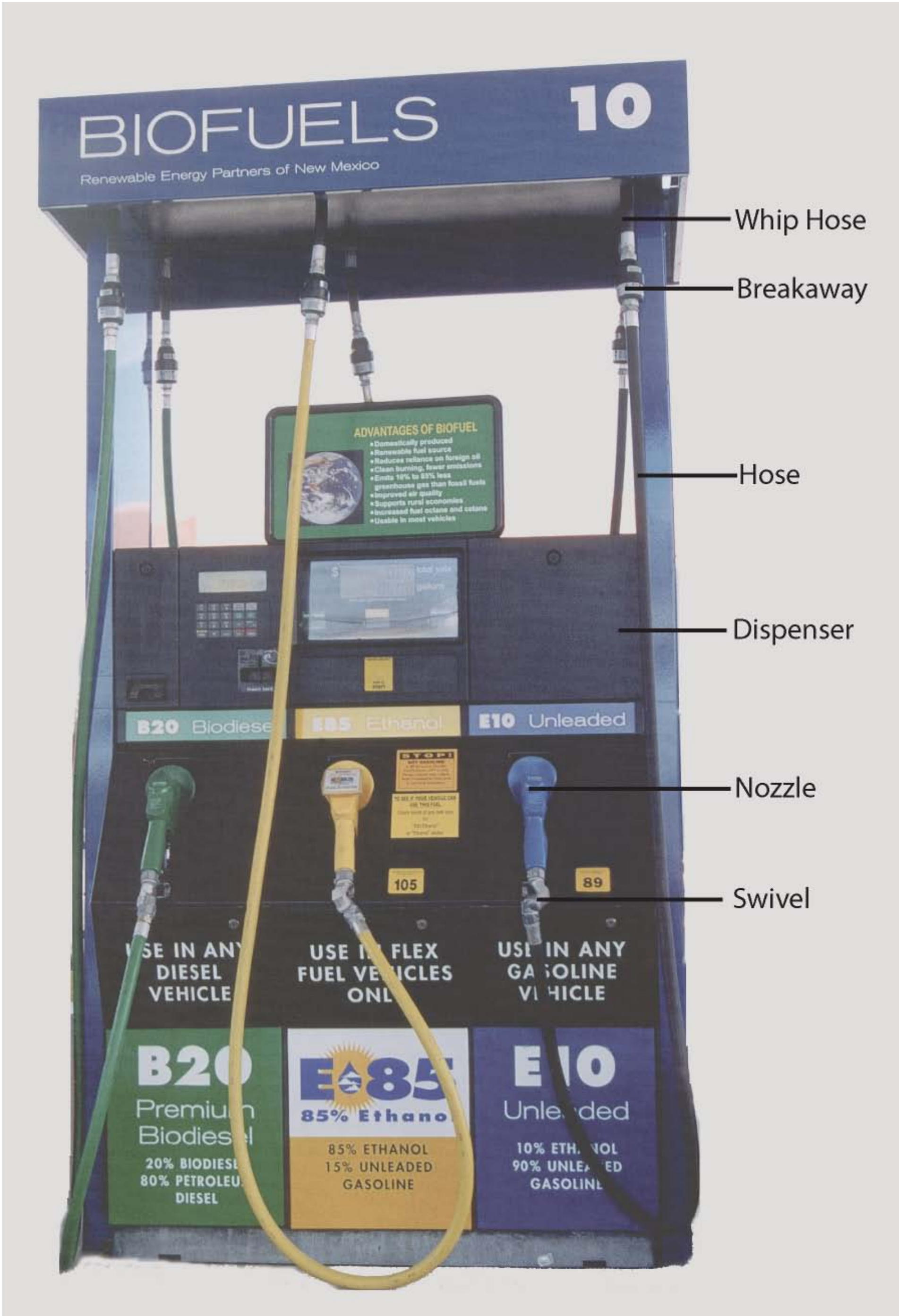


Figure 4. GC-MS graph showing an acid fragment formed by the cleavage of a long chain hydrocarbon elastomer. The ester and ether groups of the hexanoic acid are shown as sites where hydrolysis occurs.

Appendix B



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14. ABSTRACT *(Maximum 200 Words)*
The National Renewable Energy Laboratory's (NREL) Nonpetroleum-Based Fuel Task addresses the hurdles to commercialization of biomass-derived fuels and fuel blends. One such hurdle is the unknown compatibility of new fuels with current infrastructure, such as the equipment used at service stations to dispense fuel into automobiles. The U.S. Department of Energy's (DOE) Vehicle Technology Program and the Biomass Program have engaged in a joint project to evaluate the potential for blending ethanol into gasoline at levels higher than nominal 10 volume percent. This project was established to help DOE and NREL better understand any potentially adverse impacts caused by a lack of knowledge about the compatibility of the dispensing equipment with ethanol blends higher than what the equipment was designed to dispense. This report provides data about the impact of introducing a gasoline with a higher volumetric ethanol content into service station dispensing equipment from a safety and a performance perspective.

15. SUBJECT TERMS
ethanol; e15; service station; infrastructure; fuel; dispensing equipment

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Contract No. DE-AC36-08GO28308

April 5, 2013

Comments by Viesel Fuel, LLC and Triton Energy LLC

Submitted by email: rfs@mail.house.gov

Comments to Renewable Fuel Standard Assessment White Paper:
Blend Wall/Fuel compatibility Issues

In response to the Energy and Commerce Committee's first White Paper regarding the Blend Wall/Fuel Compatibility issues, we offer the following comments. Given that our expertise does not pertain to automotive engine compatibility with E15, responses are limited to a few questions. In general, Triton Energy and Viesel Fuel support the Renewable Fuel Standard and believe that it is an important policy to diversify the nation's fuel supply, create jobs and protect the environment.

8. *Can blend wall implementation challenges be avoided without changes to the RFS?*

In our estimation, blend wall implementation challenges can be avoided without statutory changes to the RFS, but regulatory and EPA implementation changes are required. First, the RFS2 has limited the types of biofuels that may be used for "home heating." All biofuels approved under the RFS2 should be permitted to heat spaces for people , hence providing relief by reducing the amount of ethanol required to meet the biofuel mandate. Further, the fuels used for heating spaces for people tend to have a higher energy density and therefore higher RIN value, reducing the amount of biofuel needed to meet the mandate.

Implementation of the Renewable Fuel Standard in terms of approving new advanced biofuel processes and facilities has hindered the expansion of biofuel technologies and facilities. Delaying advanced biofuels from entering the market further entrenches existing technologies and makes funding from the private sector for new biofuel facilities even more challenging given the precedent for biofuel facilities failing due to regulatory delays of sometimes over two years.

Next, the regulations for the RFS2 do not encourage any improvements to the existing ethanol facilities. It is within EPA's discretion to provide incentives to the existing ethanol industry to make efficiency and greenhouse gas (GHG) footprint upgrades. EPA could encourage the existing ethanol industry with incentives such as providing higher RIN values per gallon for facilities with an improved GHG reduction footprint or upgrading such that the ethanol facility produces a "drop-in fuel" instead of ethanol. Facilities with a higher GHG reduction footprint could receive a higher RIN value which in turn actually reduces the number of gallons required to meet the RFS requirements.

Some blend wall implementation challenges can be avoided if EPA approves all RFS2 fuels to participate in the heating market and approves new pathways in a timely fashion (90 days or less).

If the RFS must be changed to avoid the blend wall, what should these changes entail?

Any changes that are made to the RFS should first clarify the definition of heating fuel and allow all biofuels approved under the RFS2 to participate in the home heating market. Next, expand the use of biofuels beyond home heating, transportation or jet fuel. All biofuels approved under the RFS2 should be permitted and therefore count toward the biofuel mandate when used in any application that requires a petroleum product. Hence, more biofuels could be used in a wider set of applications and would help reduce pressure on the transportation sector.

Next, any modifications should provide regulatory relief to new biofuel technologies such that there will be fewer delays in getting facilities and new biofuel processes approved.

Given the consumer protection concerns and liabilities with more than 10% ethanol in on-highway gasoline powered vehicles, perhaps continue to limit the amount of ethanol in gasoline to 10% until such concerns are resolved. Further, provide preference to ethanol that is derived from non-corn or non-food based feedstocks but do not lower the overall mandate given that EPA has the discretion to set the Renewable Volume Obligations (RVOs) each year.

Should any changes include liability relief or additional consumer protections from addressing mis-fueling concerns?

No comment.

9. *Have the 2017 and Later Model Years Light Duty Vehicle Greenhouse Gas Emissions and Corporate Average Fuel Economy standards for cars and light trucks changed the implementation outlook for the RFS?*

Yes, given that light duty vehicles and the corporate average fuel economy standards will increase, the amount of gasoline and diesel fuel consumed will decrease while simultaneously the biofuel mandate is set to increase. The EPA needs to be significantly more pro-active in encouraging the approval of new biofuel processes if the RFS is to succeed in light of the blend wall and decreasing gasoline consumption. In addition, the applications where biofuels could be used under the RFS2 should be clarified such that all biofuels approved under the RFS2 may be used for heating spaces for people and therefore provide greater environmental and health benefits. All RFS2 biofuels should be included for heating spaces, even in applications that presently used ASTM D396 grade fuels for heating.

10. W*hat other methods, including the use of drop-in-fuels, are available to industry to ease the challenge posed by the blend wall?*

Biofuels should be permitted to be used more widely for heating and industrial applications such that there is more biofuel that can be used while relieving pressure on the transportation sector.

11. *What are the impacts on the renewable fuel producers if the RFS is changed to avoid the blend wall?*

The impacts could be seen primarily on traditional ethanol facilities. However, the RFS was designed to push the biofuel industry to become more efficient, generate higher energy density fuels and produce biofuels that are more compatible with the petroleum infrastructure. Because advanced biofuels have a higher energy density and a lower greenhouse gas footprint they are assigned higher RIN values meaning fewer gallons are required to meet the mandate. The push to have a more advanced fuels and to allow biofuels to be used in broader applications, would achieve more environmental and health benefits and avoid blend wall challenges regarding the amount of ethanol required to be used in the transportation sector.

Triton Energy, LLC and Viesel Fuel, LLC support the Renewable Fuel Standard and the benefits that the policy provides to the country. We look forward to participating in this discussion.

Respectfully Submitted,

Connie Lausten on behalf of Viesel Fuel, LLC and Triton Energy, LLC.
cLausten LLC
Connie@cLaustenllc.com

April 5, 2013

The Honorable Fred Upton
Chairman
Energy and Commerce Committee
U.S. House of Representatives
2125 Rayburn House Office Building
Washington, DC 20515

The Honorable Henry A. Waxman
Ranking Member
Energy and Commerce Committee
U.S. House of Representatives
2322A Rayburn House Office Building
Washington, DC 20515

Dear Chairman Upton and Ranking Member Waxman:

Virent is pleased to comment on the U.S. House of Representatives Energy and Commerce Committee's first in a series of white papers reviewing the renewable fuel standard (RFS).

Virent is a Madison, Wisconsin based company that uses patented catalytic technology to convert plant-based materials into a range of products identical to those made from petroleum, including gasoline, diesel, jet fuel, and chemicals used to produce plastics and fibers. Please visit www.virent.com for more information.

As the committee is aware, the Renewable Fuel Standard (RFS2) was expanded as part of the Energy Independence and Security Act of 2007 (EISA), which created specific requirements for advanced biofuels, including the biomass-based diesel, advanced, and cellulosic biofuels pools. The clear vision of Congress in drafting this statute was to encourage the production of an entirely new range of fuels from a broad and diverse array of feedstocks. We agree that many factors such as the changing US energy landscape, the speed of advancement of various technologies and also prominent industry failures have made this an appropriate time to re-assess the course and implementation of the RFS2 program. We applaud the committee's efforts in this regard.

Based on Virent's technology and position within the biofuels and bio-based chemicals industry, we feel it is appropriate for us to comment on three (questions 8, 10 and 11) of the eleven questions posed by the white paper.

Question 8: Can blend wall implementation challenges be avoided without changes to the RFS?

Possibly, but it will be difficult. The RFS is an essential market driver for the development of advanced biofuels. Increased availability of direct replacement, advanced biofuels is the solution to the conflict between ethanol blend wall limitations and increasing RFS mandated volumes.

The most obvious solution to the blend wall is to limit ethanol to E10 in the US gasoline pool and meet the remaining mandated volumes with other biofuels, including drop-in renewable fuels. On a related point, on page 2 the white paper (second paragraph from the top) refers to the "mandated amounts of *ethanol in the RFS." However, ethanol (the molecule) is not mandated, but merely permissible, under the RFS. This seems routinely to get lost in any discussion about the RFS and its future. Virent would like to emphasize that there are alternatives to compliance in both the Renewable and Advanced Biofuels pools that do not expand the use of ethanol in the US.*

The ethanol industry has been very successful in delivering high volumes of renewable biofuel into the US market over the last 30 years. However, it is clear that Congress's goal with RFS2 was to incentivize the development of more advanced forms of biofuels. Establishing a cap on the amount of ethanol in the gasoline pool at E10 would both solve the blend wall issues as well as drive increased investment toward drop-in and other advanced biofuels.

Is the existing EPA waiver process sufficient to address any concerns?

Virent believes that this may be sufficient in the short term, but more difficult as the gap between the mandated conventional pool and the amount of ethanol that can be reasonably included in the US gasoline pool widens. As stated above, establishment of a firm and compatible ethanol maximum blend, through whatever regulatory or legislative means necessary, is the most cost effective and sensible method of addressing this issue.

If the RFS must be changed to avoid the blend wall, what should these changes entail?

We do not believe that fundamental changes to the RFS are required at this time. However, if changes were required to meet the goals of the program we would suggest consideration of the following additional items:

- *Establish a cap for ethanol at E10 with specific volumes tied to the projected size of the gasoline pool. This will greatly strengthen incentives for the production of drop-in biofuels.*
- *Create performance based incentives that promote infrastructure compatibility and incremental improvements in GHG reduction in addition to the existing incentives for higher energy content.*
- *Allow biorefinery co-products that displace fossil carbon, including chemicals, to qualify for RINs. This would broaden the pool of available RFS compliant product streams.*

Should any changes include liability relief or additional consumer protections for addressing misfueling concerns?

Limiting ethanol to E10 would immediately eliminate the risk to consumers or the need for the government to intervene in this arena. Drop-in biofuels, which generally offer identical performance of their fossil fuel equivalents and can be produced, blended, distributed, stored, sold and used without restriction, would not need these protections.

Question 10: What other methods, including the use of drop-in fuels, are available to industry to ease the challenge posed by the blend wall?

One way to address the blend wall is to increase investment in and development of drop-in biofuels, which have the same properties and composition as petroleum-based fuels and may be used in existing infrastructure. Because of these important performance characteristics, existing downstream petroleum infrastructure and engines can run on these fuels without restriction. The primary challenge for drop-in *biofuels is creating a policy framework that promotes investment in commercial facilities (which is driven by the overall stability of the RFS policy).*

Moreover, drop-in biofuels will open additional markets, including aviation fuels, to the industry. Both the military and the commercial aviation industries have expressed strong interest in the development of the fuels to help them meet their long-term energy security and sustainability goals. Additionally, the aviation biofuels market is well suited for the introduction of biofuels. It has highly concentrated nodes of supply and demand, where the 40 largest US airports account for more than 90 percent of jet fuel used by commercial aviation. Thus, if a sustainable aviation biofuel producer can deliver to the 40 largest airports, they have access to nearly the entire 17 to 19 billion gallon-per-year commercial jet-fuel market.

Finally, expansion of RFS RIN eligibility to chemical co-products would broaden compliance options consistent with the overarching goals of the program. These products greatly improve biorefinery economics and the additional incentives of RIN eligibility would help spur investment in larger and more integrated biorefinery projects.

Question 11: What are the impacts on renewable fuel producers if the RFS is changed to avoid the blend wall?

Even if ethanol were to be capped at the blend wall, ethanol producers would still flourish and maintain their current market share of 8-10% of the gasoline pool. This market would be driven both by the need to blend ethanol as an oxygenate and by favorable relative economics. The ethanol industry also would retain the ability to export their product to other global markets.

A stated above, solving the blend wall in this manner also would spur investment and development of drop-in fuels in order to comply with the volumes mandated in the RFS. This increased investment would create and expand newer technologies with lower GHG emissions, promote job creation and spur additional rural development across a broad array of both conventional and second generation feedstock production. Additionally, biofuels are typically lower in other toxins found in petroleum fuels, such as sulfur. Use of these fuels would also contribute to the attainment of other policy and environmental goals.

Once again, we appreciate the opportunity to comment and hope this information is beneficial to the Committee as it begins its review of the RFS and how to address the challenges surrounding the blend wall. If there are any questions please do not hesitate to contact me at (202) 507-1316 or david_hitchcock@virent.com.

Sincerely,

David Hitchcock
VP, Government Affairs
Virent, Inc.